

THE
Electro-Therapeutic Guide,

—BY—

WILLIAM F. HOWE, M. D.

—AND—

HOMER CLARK BENNETT, M. D.

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THE ELECTRO-THERAPEUTIC GUIDE

—BY—

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ENT ELECTRO-THERAPEUTIC SANITA-
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SIXTH EDITION

Revised and Enlarged.

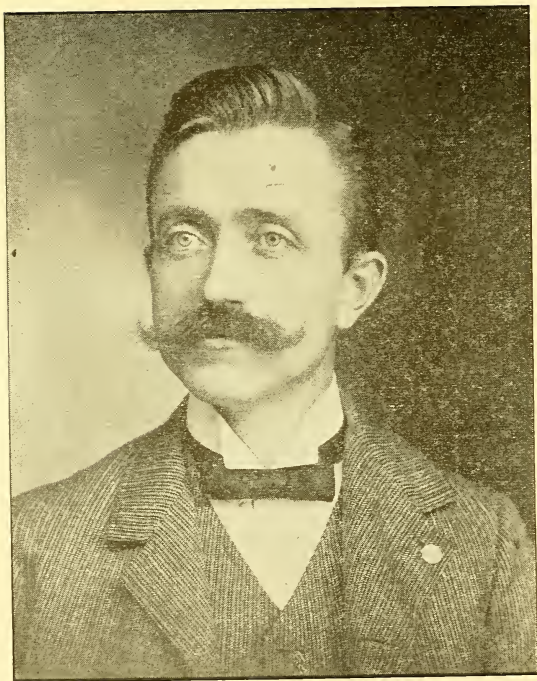
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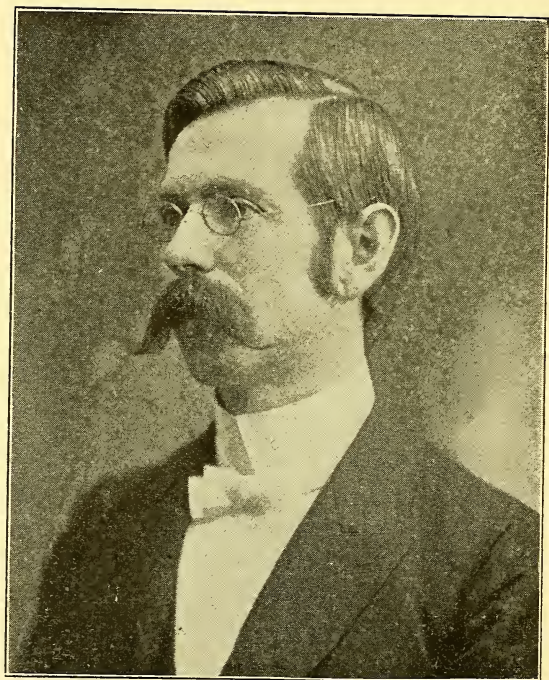
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WILLIAM F. HOWE.

PREFACE TO FIRST EDITION.

This little work is intended as a guide or aid to the correct use of electricity in the hands of the general practitioner.

A physician who is obliged to cover the entire field of medical and surgical practice cannot be expected to keep in mind all the little details of electro-therapeutic practice.

The guide has been arranged in this form that a busy practitioner may see at a glance the methods of application in any desired case.

We believe that this guide will save much time and insure a more scientific and successful use of electricity in the hands of the average physician.

In following out the treatments outlined in this work any intelligent physician will take into consideration the age and sex of the patient, individual idiosyncracies, etc.

No originality is claimed by the author in the methods of treatments given. The general rules given and the methods of treatment advised are in accord with the best electro-therapeutists.

It is believed, however, that this is the first attempt to so thoroughly simplify and condense electro-therapeutic applications as to enable the busiest of general practitioners to ascertain without unnecessary study and loss of time how to make the correct appli-

cation in the class of cases coming to the average physician.

It is not expected that this work will take the place of a text-book of electro-therapeutics or a lecture course upon this subject.

This work is not written for the specialist in electro-therapeutics, but for the general practitioner with but limited knowledge on the subject. W. F. H.

PREFACE TO THIRD EDITION.

The first two editions of this little work have met with such favor from the medical profession that a third edition becomes necessary.

Some changes have been made, particularly in the chart form, which it is hoped will be approved by the profession.

Hundreds of physicians who would not have devoted their time to a thorough study of electro-therapeutics from a large text-book, and who could not have taken a post-graduate course in this subject have, with the aid of this Guide, been enabled to apply electricity in a thoroughly scientific and successful manner and have secured results which would have been impossible without the knowledge therein contained.

If this little work will assist the busy practitioner and guide him to proper methods of applying electricity in diseased conditions, securing results that would otherwise have been failures; and if it will interest him in the subject of electro-therapeutics and stimulate his desire for knowledge along this line and cause him to give more attention to this important branch of medical practice, the author will be satisfied.

W. F. H.

PREFACE TO SIXTH EDITION.

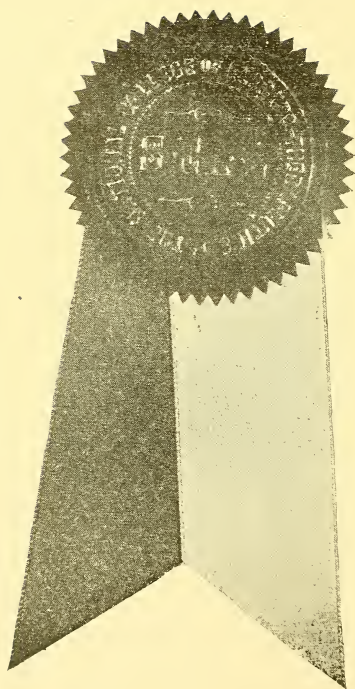
The fact that this little work has met with such general favor as to exhaust five successive editions in as many years, is, we think sufficient warrant for the publication of the present edition in its revised, improved and enlarged form. As stated in the previous editions, and as the name indicates, this book is only intended as an aid to the beginner, and a guide to the busy doctor using electricity as a medicine, and not as a text-book or course of instruction.

"The Electro-Therapeutic Guide" is the only book of the kind published, and was intended primarily as a part of the Mail Course of instruction of The National College of Electro-Therapeutics, which it still is, but it is in demand by many who are already posted in electro-therapeutics, or who do not care for or need the course of instruction.

It contains the essence of the course without any useless words, and will, we hope, accomplish the purpose intended, which is to give the most important items or facts in the great science of electro-therapeutics, telling where, when and how to apply electrification, without telling why, as that is taught fully in the course of instruction of the National College of Electro-Therapeutics, and in many large books.

H. C. B.





What Is Electricity?

This question is often asked by the unthinking and thinking alike, and has never yet been answered definitely. Many theories are offered, all with some points in favor, but they are none of any value to us. While we do not know *what* it is, we do know what it is *not*. It is not a tangible entity. It is *not* a form of energy, as many claim. Electricity is a *condition*. Electrification is an energy, or manifestation of the presence of electricity, and we know *some* of the laws governing electrification, and can, by following these laws, bring about certain manifestations of electrification, and get certain results. Perfect equilibrium of electrification constitutes perfect health and no phenomena. An excess of electricity is positive electrification, and an absence of, or lowered state, is negative electrification, and either plus or minus will produce phenomena, disease or even death.

It is upon the laws governing the production of these phenomena that is based the science of electrotherapeutics, and these laws *must* be known and followed in order to achieve success. Occasionally we are amused by some one making a "discovery," (save the mark,) claiming to have found out what electricity is, and he either guards his secret (?) closely, or gives a very old and confusing job lot of meaningless words, as a definition.

So do not be afraid to show your ignorance as to what electricity is, for you are in very good company, as the wisest do not know, and in that respect we are all wise.

KINDS OF CURRENTS,

In general terms we speak of using three kinds of currents or forms of electrification, viz:—*Galvanic*, *Faradic*, and *Franklinic*. While the proper names of the first two are retained, the last named is usually called *Static*. The correct terms to be used should be constant, alternated and static. Under these heads will be classified the *Cautery*, which is Galvanic; the *Sinusoidal*, which is Faradic; and the *Static induced*, which is Franklinic.

Commercial incandescent currents can be utilized for the purposes of galvanism, faradism, and for the sinusoidal and cautery effects, but they differ in no way, except in the method of generation, from the first named currents.

The Galvanic Current.

This current produces no sensation beyond a slight feeling of heat or burning beneath the negative electrode and a slight, numb sensation beneath the positive electrode.

In those peculiarly susceptible, or afraid electricity will hurt them, the galvanic current can be used where the faradic would not be tolerated.

The galvanic current has greater power of pene-

tration and sedation than the faradic current, no matter which coil is used in the latter.

In the galvanic current the positive pole is, to a marked degree, more sedative in its effect and the negative pole more stimulating and irritating.

The galvanic current produces a chemical effect in the tissue and can be used to produce electrolysis, cataphoresis, etc., while this is not true of the faradic current. The positive pole attracts oxygen and the acids. The negative pole attracts hydrogen and alkalies.

The galvanic current has a greater effect upon nutrition and will stimulate the absorbents and assist in removing hypertrophies, effusions and morbid growths where the faradic current would be useless.

The galvanic current is the only current that can be used in removing superfluous hairs, facial blemishes, hemorrhoids, urethral stricture or wherever the process of electrolysis or cataphoresis is to be employed.

The galvanic current affects the nervous system more profoundly than the faradic. It will also, by reversals of the current direction, cause muscular contractions in some cases where the faradic current fails. It produces greater molecular changes in the tissues and possesses a greater catalytic action.

The interrupted galvanic current is used where it is desired to produce strong mechanical effects. The slower the interruptions the more vigorous will be the muscular contractions. In some chronic and exceedingly obstinate cases, where the faradic current has little, if any, effect, the interrupted galvanic current will produce the desired result.

The interrupted current has greater stimulation

and irritation than the constant current. The interrupted galvanic current is the most useful in treating obstinate cases of rheumatism, muscular atrophy, local anesthesia, paralytic conditions and a similar line of diseases.

The interrupted current is of decided advantage in a certain range of conditions, but is used but rarely as compared with the constant.

The milliampere meter measures the strength of the current in transit through the body.

Two to four milliamperes are sufficient over the forehead, around the eyes, upon the face, or over any delicate or sensitive part.

Upon the spinal cord from five to twenty milliamperes may be used, and over the stomach, abdomen, thighs, etc., from fifteen to fifty, while in dispersing fibroid tumors it will be necessary to employ from one hundred and fifty to two hundred and fifty.

The milliampere meter can only be used with the galvanic current.

If one does not have a meter and is obliged to depend entirely upon the number of cells being used as a guide to current strength it may be stated that one to three cells of the ordinary battery would be considered a mild current and would be sufficient over the eyes, forehead, or other very sensitive parts. From two to ten cells might be employed upon the spinal cord; five to ten cells upon the limbs or the abdomen where there is little adipose tissue, and from six to fifteen cells where there is much resistance to overcome in corpulent patients. In the treatment of fibroid tumors it will be necessary to employ from twenty to forty cells.

The rheostat or current controller, interposes a

resistance to the passage of the current and by increasing and decreasing the resistance by the aid of the rheostat, the galvanic current can be applied without any shock to the nerves, which is unavoidable without the use of the rheostat. This instrument is placed in the circuit, usually attached to the battery, and by its aid the current can be applied so as to begin treatment with almost no perceptible current. In using the galvanic current the treatment should be commenced with a very mild current gradually increased to the desired point, and then decreased before the electrode is removed.

In using strong galvanic currents it is essential that the current is not abruptly broken. The rheostat or current controller is the only successful and convenient method of regulating the strength of the current.

The Faradic or Interrupted Current.

The faradic current is so called from its discoverer, Faraday. It is produced by means of a double coil of wire through the larger or primary coil of which passes an interrupted galvanic current. One to three cells give sufficient current.

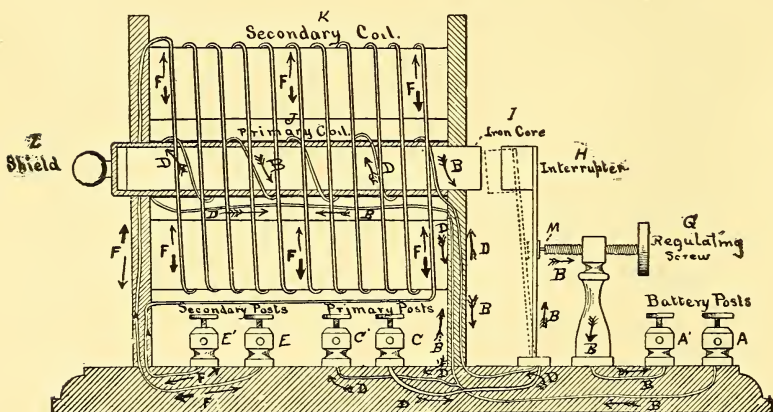
A good dry cell is most satisfactory for a portable faradic machine, while some form of the LeClanché fluid cell is preferable for office use. The dry cell is not so expensive in faradic batteries, as only from one to three are used at a time.

This current acts more markedly upon the muscular system.

It produces muscular contractions more readily than the galvanic current. It also produces greater mechanical effects.

The strength of current is regulated by the sensibility of the patient.

The primary coil of the faradic battery gives more a current of quantity than tension, i. e., the current lacks tension and power of penetration but will produce more powerful superficial muscular contractions than the secondary current.



Working Diagram. Physicians Induction Coil

The primary coil produces a current that is more stimulating and irritating than the secondary coil, hence the primary coil would be used in affecting capillary circulation, in producing powerful muscular contractions and in stimulating a paralyzed nerve if near enough the surface to be reached by the primary current.

In the current from the primary coil the positive pole is more sedative and the negative more stimulating in its effect.

The principal differences in the primary and secondary currents are as follows:

The secondary current is an alternating current of high tension or voltage, and low quantity or amperage. It is an induced current which is caused to flow as an alternating current by the action of the interrupted galvanic, through the primary around the soft iron core. The number of alternations depends upon the number of vibrations of the iron hammer; or, rather, as stated before, the number of interruptions of the galvanic current.

The primary current more nearly resembles the galvanic. It is a current of usually lower tension or voltage, and higher quantity of amperage.

The secondary coil produces an induced current having greater tension and penetration and sedation than the primary coil, and is of greater service in treating diseases of the nerves or any deeply seated condition.

The current from the secondary coil is pleasanter and less pain is felt when strong currents are used than in the primary.

In the secondary current there is very little, if any, difference in effect between the positive and negative.

In using the faradic current—either primary or secondary coil—it is safe to use as strong a current as the patient can take without pain or unpleasantness.

The number of interruptions per minute in the faradic battery—any coil being used—can be varied by adjusting the screw which regulates the vibrator.

With a comparatively small number of vibrations the current would have greater power to produce muscular contractions, it would be more plainly felt, would cause greater pain if a strong current was used

and would be more irritating and stimulating in its effect. The greater number of vibrations per minute the less pain is experienced, less powerful muscular contractions and greater sedation.

STATIC ELECTRICITY.

Static electricity is used as a therapeutic agent by the general practitioner comparatively but little, partly owing to the expense of a serviceable static machine, and perhaps still more to the fact that static electricity has not received the attention in our medical journals and medical colleges that the galvanic and faradic currents have received.

Static electricity has characteristics and advantages that should be understood by every practitioner who desires to make use of electricity in any of its forms.

While static electricity is not called for as frequently as the use of the galvanic and faradic currents, yet there are occasions where it is greatly to be preferred.

It is a little singular that the static current has not been used to a greater extent when we consider that it was discovered long before the other forms of electricity used in medical practice.

The history of frictional electricity dates back 600 years B. C., when Thales, the Greek philosopher, discovered that when amber was rubbed vigorously it had the property of attracting or repelling other bodies.

We cannot deal here with the history of static electricity from its discovery to the present time, although it would be very interesting; and we advise the reader who is sufficiently interested in electro-therapeutics to read its history in some reliable work upon the subject.

Nearly every physician has seen a static machine, and all must have seen cuts of them which will give a better idea of their construction than any pen picture.

In the galvanic or faradic currents the electricity is generated in cells, with which all physicians are familiar, while in the static machine the current is generated by *induction*.

In the first static machines there were two glass plates, one stationary and one revolving. In the best static machines of the present day there are twenty-four plates, twelve revolving and twelve stationary.

We will not enter into the construction of the static machine, but would refer those physicians who are not familiar with its mechanism to an encyclopaedia or a catalogue of electro-therapeutic appliances which will give accurate descriptions and cuts of the various machines.

The methods of applying static electricity are the following:

Static Insulation.

Static Breeze.

Static Induced Current.

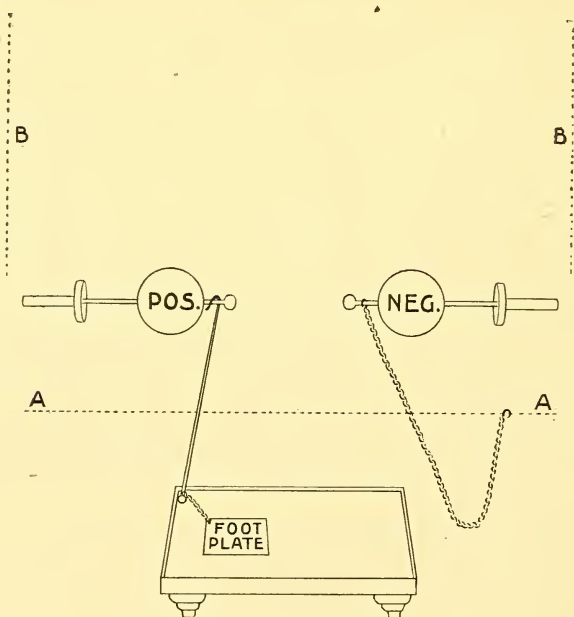
Direct Spark.

Indirect Spark.

Potential Variation or Surging.

Static Insulation is one of the most agreeable methods of applying electricity.

The patient is placed upon an insulated platform, to which is attached one pole of the machine. The other is grounded by connecting the conducting cord or chain to the ground wire. The poles of the machine should be separated widely. Upon the machine being put in motion, the patient experiences a pleasant tingling sensation and frequently gentle perspiration is started. The treatment produces no pain or shock.

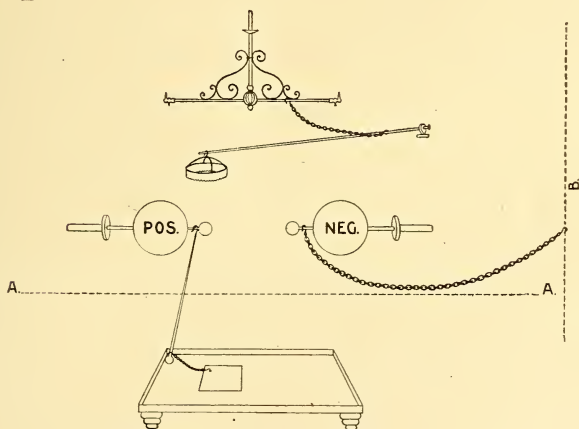


Positive Electrification. (Insulation.)

For Negative Electrification the positive pole is grounded and the negative carried to the platform. Have patient place both feet on foot plate.

N. B.—A. A. and B. B. represent wires, connected to the earth, water or gas pipes, to ground one pole.

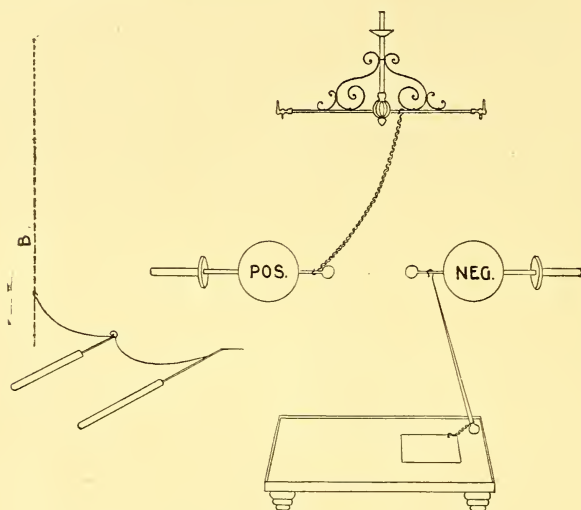
The physician or operator should avoid approaching the patient too closely, or a spark will be drawn from the patient which causes for a moment an unpleasant sensation. Static insulation produces a general tonic effect, also a sedative effect upon the nervous system. This is the preferable treatment to give in cases of neurasthenia, chorea, insomnia, and nearly all nervous diseases. The improvement is almost invariably rapid, and the patient will usually feel better after the first treatment.



Stationary Negative Breeze.

While using this treatment for some trouble, the patient will frequently obtain relief from a chronic case of constipation, dyspepsia, asthma, and many other diseases. Static insulation is given by many physicians in preference to "general faradization" or "general galvanization." In many cases at least it will accomplish the same results, and its application is

much more pleasant and less troublesome to the patient, as no clothing has to be removed.



Local or Moving Positive Breeze.

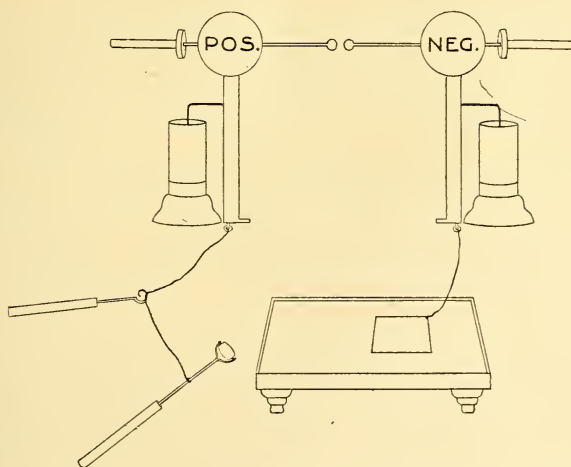
The Static Breeze is, like static insulation, a very agreeable treatment.

The patient is again placed upon the insulated platform (so as to retain a charge of electricity), to which is attached one pole of the machine. The other pole communicates with a metal crown or cap, studded with points, which is placed a few inches above the head. Some physicians claim the positive pole in this treatment is more sedative and the negative pole more stimulating.

In neuralgia of the face or head the static breeze will almost always give prompt relief. It is one of the very best treatments in obstinate cases of insomnia.

It is also of service in some cases of epilepsy, insanity, etc.

If it is desired to use the breeze upon some portion of the body beside the head, head-crown may be dispensed with and the same pole attached to a metal brush or other electrode and brought to bear upon any portion of the body. The electricity is then withdrawn from the patient's body. The electrode should be held from one to three inches from the body. The breeze is very plainly felt and produces a very pleasant sensation. If it is desired to concentrate a powerful current upon some portion of the body, a pointed metal electrode may be used which will intensify the effect of the treatment at the desired spot.



Massage Roller Application with Static Induced Current.

Where very mild currents are to be used, it is best to employ a wooden electrode.

In giving this treatment, if the electrode is brought too near the patient, a shock and a spark will be produced. This is a most excellent treatment in muscular rheumatism, sciatica, muscular atrophy, anæmia, and many other conditions.

The Static Induced Current corresponds very closely to the faradic current. To produce the static induced current it is necessary to attach a pair of leyden jars to the arms of the machine. The larger the jars the more powerful the effect of current, hence two or three sets of jars are frequently employed.

In this treatment it is not necessary for the patient to be placed upon an insulated platform. One end of the cords or wires must be attached to the outer coating of the tin foil on the leyden jars.

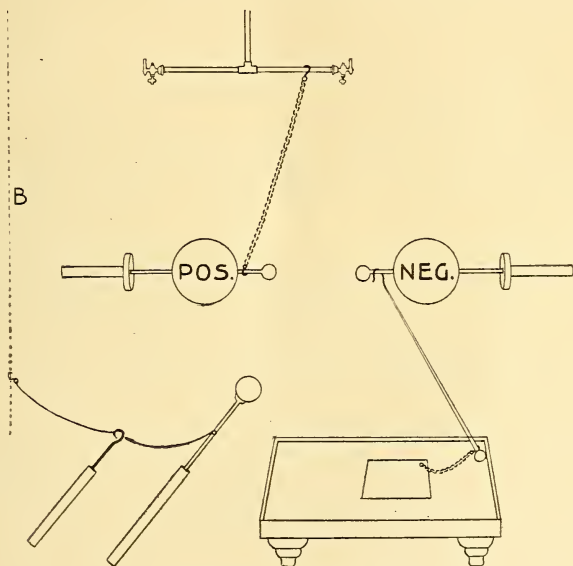
The other end of the conducting cords are attached to electrodes, and these applied to any part of the body. The poles of the machine must be brought near together (not touching) before the machine is started. Separating the poles increases the effect of the treatment and must be done very carefully or too powerful an effect will be produced. The sensation and effect produced by the static induced current are almost exactly the same as those of the faradic current.

In the static induced current there is a much greater electro-motive force and fixed polarity. The static induced current may be used wherever the faradic current would ordinarily be employed and is probably the most powerful tonic of the two.

Leyden Jar Currents.

Graduated by the size of the jar employed, the speed of the machine, and the spark gap between

the balls of the sliding rods. The applications are usually made to the bare skin with the roller, damp sponge electrodes or variously in the same manner as the ordinary application from an induction coil, the speed of the machine regulating the interruptions and vibrations, and without the insulating platform.

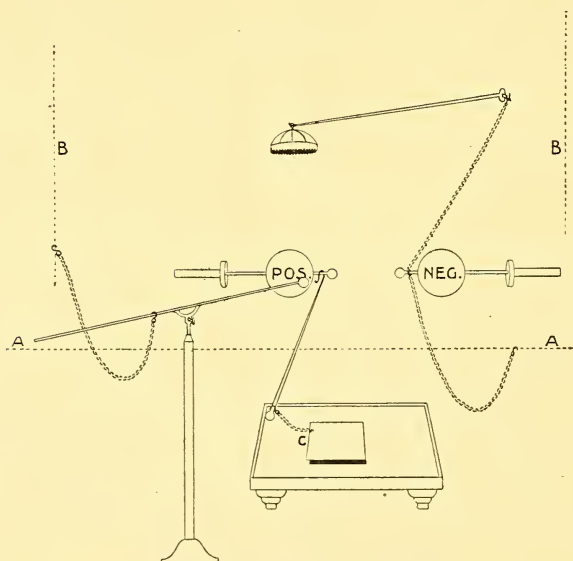


Positive Indirect Spark.

The Direct Spark is given by placing the patient upon the insulated platform, to which one pole of the machine is attached, while the other is brought to bear upon the parts to be treated. The electrode should be held near to, but not touching, the clothing, directly over the part to be treated. The greater the distance between the electrode and the patient the more severe is the effect.

More rapid revolutions of the plates will also increase the effect of the spark.

The Indirect Spark is given with the patient upon the insulated platform, to which is attached one pole of the machine, or this pole may be attached to the stool upon which the patient is seated, or held in the hand.



Potential Variation, or Surging.

C. A pad of newspaper is placed between the foot plate and the feet of the patient, or the bare feet are better placed on a wet towel to avoid irritation in this form of treatment.

A chain or conducting cord communicating with the other pole of the machine is then grounded by placing it upon the floor. Another chain is then attached to a gas, or water pipe, and the other end

provided with a suitable electrode brought near the patient, as in the "direct spark" treatment.

The poles of the machine should be separated a considerable distance. Rapidly revolving the wheels of the machine will increase the effect. The length of the spark will depend upon the condition of the atmosphere, perfect insulation, and the power of the machine.

Static sparks, either "direct" or "indirect," are of very great service in treating contracted muscles, muscular atrophy, muscular spasm, some forms of severe neuralgia, various forms of paralysis, chronic synovitis, etc.

The treatment of static insulation and static sparks, given at the same seance, produce very pleasant results in a large range of cases.

Potential Variation, or Surging

is used to produce a wave like surge or vibration among the tissue cells. It gives the muscles work and stimulates contractions in a mild form.

The ball electrode on the standard is used as an interrupter, drawing sparks from the prime conductor instead of from the patient. The simplest and therefore the best way to get the wave surge is to omit the standard and ball rod. Ground the negative side of the static machine, or better still, attach the negative side to the overhead crown, placed two or three feet above the patient's head. Then attach positive side of machine to platform, footplate, or better to the bare skin of the patient, with a wet sponge electrode placed directly over the part most affected. Bring the sliding rods of the prime conductors together,

start machine and gradually separate sliding rods, as in the static induced treatment. The length of the spark gap regulates the force of the wave surge. If the roller electrode is attached to the machine by a cord it may be applied to any or all muscles in turn, and rapid or slow, mild or powerful, but painless contractions may be set up.

To give perfect exercise to the arms wind positive chain around bare forearm and proceed to interrupt the current, or make positive connection with bath and immerse the hand. Every muscle of the arm will be brought into play and with continuous exercise the arm becomes brown and tanned.

This form of treatment has been found of wonderful benefit in Brights disease and diabetes by attaching the positive pole to a bifurcated wet sponge electrode to the bare skin over the kidneys. Some apparently hopeless cases have been symptomatically cured, without drugs or diet with this simple treatment.

In using static electricity the subject of polarity is not considered, except by very few who claim to be able to produce different results with the two poles.

This has not been the experience of the writer, and it is generally admitted that the same effect may be produced by either pole.

The polarity of the static machine frequently changes, and what is the positive pole during one treatment may be the negative pole during the next treatment. (See polarity tests on another page.)

Static electricity does not produce any of the chemical effects which are obtained through the galvanic current, and in electro-therapeutics many things may be accomplished through the chemical effects of the galvanic current that would be impossible with the

static machine. Static electricity possesses very small amperage or quantity, but very great voltage or tension.

As previously stated, however, much, if not all, of the work usually accomplished with the faradic current, might be performed with static electricity.

The principal advantages in the use of the static machine over the faradic current, are that we have a much greater electro-motive force and that the patient has to remove no clothing.

The latter is a decided advantage in treating many patients. Many timid lady patients, who would not disrobe or properly adjust their clothing for a treatment of general faradization or general galvanization, will have no hesitancy in taking static electrification.

Cases of hysteria, neurasthenia, chorea, melancholia, hypochondriasis, and other allied diseases, will receive greater and more prompt benefit from static electricity than perhaps from any other treatment.

While static electricity produces no chemical effect in the tissues, it will increase the circulation, improve nutrition, assist digestion and assimilation, promote absorption, and quiet, refresh and invigorate the nervous system.

EFFECTS OF THE DIFFERENT CURRENTS.

Some of the points of advantage of the faradic battery are—that it is smaller and more portable; the current is much more plainly felt, and is more pleasant to the average patient, and the sensations are such as to cause greater confidence in the treatment and

appreciation of the effects than with the galvanic current, where little, if any, sensation is produced and where the patients frequently insist they are receiving no current, even though a moderately strong current is passing.

The faradic battery can be more easily carried by the country physician. Some of the advantages of the effects of treatment of the faradic over the galvanic current are, it produces muscular contractions more readily, produces greater mechanical effects, stimulates the circulation more powerfully and is less likely to produce an aggravation in the treatment of disease if improperly used. In the faradic current there is very little, if any, chemical effect, and electrolysis or cataphoresis cannot be secured.

There are very many points of similarity in the effects of the two currents and many conditions can be successfully treated with either current. This will be referred to later. There is but little trouble in keeping a faradic battery in working order. When purchased, directions accompany them for the proper starting of the current, the fluid to be used, if it is a liquid battery, etc. Care should be taken that the contents of the cells are not spilled upon the battery. If the contact points become corroded or rusty it interferes with the current. The vibrator spring should always be kept clean, any dust or grease frequently stopping the current.

Electricity acts in three ways, viz., through Electrolysis, which is a chemical effect from the galvanic current only; Cataphoresis, which is a mechanical effect from the galvanic and static currents; Catalysis, which is a physiological effect derived from the galvanic, faradic and static currents.

ELECTROLYSIS.

In order to bring the matter to the notice of those who have not given much, if any study to the subject, it may not be out of order to briefly state the chemism of electrolysis.

Electrolysis is the chemical decomposition of a compound body by electricity; anything that is subject to electrolysis is called an electrolyte, and as a compound body must contain water and a salt.

Nicholson and Carlisle discovered the process of electrolysis, and in the year 1800, decomposed water into oxygen and hydrogen—so that the theory and process is not new.

The galvanic current is the form that causes chemical decomposition, and the two poles have each a different potential, and for convenience the pole having the higher potential is called the positive, and the one having the lower potential is called the negative pole. The galvanic form has a constant, steady, silent current, and when applied mildly, will stimulate absorption and is useful in the removal of strictures, sub-involution, hyperplasias, exudates and foreign deposits, while with a powerful current, you can burn, cauterize or even destroy tissues.

The two poles have a still further dissimilarity in the marked difference in the chemical action of each. At the positive pole oxygen and the acid elements are liberated, and with powerful currents it has the effect upon living tissues of an acid caustic, causing coagulation of albumen, a shrinking of tissues and a

superficial, dry, white, hard cicatrix, and with a few exceptions, when a bare metal electrode is used there is a corrosion of the metal and a deposit of the metallic salts in the tissues.

At the negative pole, hydrogen and the alkaline elements are liberated, and upon living tissues it has the effect of an alkaline caustic, not coagulating albumen, nor shrinking tissues, but produces a deep red, moist, soft condition, and when bare metallic electrodes are used there is no corrosion of the metal, nor deposition of the metallic salts.

Thus when we see what vast difference there is between the action of the two poles, we realize how important it is to understand that difference, for if we go to guessing or applying it haphazard, we have only one chance in two of hitting or missing it, and that chance of success or failure.

Now in dense fibrous tissue, knowing the different action of the two poles, it is easy to select the negative pole to resolve and remove them.

In other conditions, even where we have soft vascular growths to remove, where for cosmetic effect we do not wish any scar or white contraction to appear, the negative pole is again indicated, although the positive, at first thought, seems the more preferable.

By the local use of cocaine, minor operations can be done painlessly, with all the different methods of operating.

The caustic method is slow, and it is difficult to limit the penetration and spreading of the caustic, and it has to be repeated several times.

The cautery method is quicker and safer than the caustic, but with the cautery we leave a burn that heals by granulation, and has the danger of either an

ulcer or a contractile scar resulting, and besides, the sound and smell and thought of the burned flesh is unpleasant and revolting to the finer sensibilities.

The ligature is slow, painful, dangerous and is liable to result in gangrene or sepsis with all their attendant evils.

The cutting operation is bloody, requires sutures, removes a portion of the tissue without putting anything in its place, shortens the tissues and leaves a scar.

The electrolytic method is quick, safe, painless, aseptic, bloodless, and leaves very little or no scar, and is the ideal and most rational method for the removal of all small growths of the face, hands, rectum or genitals, and is the only safe and reliable method of removing superfluous hairs.

There is no branch or principle in relation to medicine and surgery that is more clean, exact and scientific than that of electrolysis of the living tissues, when intelligently and properly applied.

CATAPHORESIS.

By cataphoresis or cataphoric medication is meant the introduction into the body of medicaments by the aid of the galvanic current. It has been found that many medicines, particularly those containing alcohol, ether or chloroform, will permeate the skin or mucous membranes much more readily when aided by the galvanic current. The direction of osmotic action is from the positive to the negative pole. If the positive sponge of a galvanic battery be saturated

with some volatile preparation and the circuit be completed the medicament will travel through the tissues beneath the skin with the current, to a considerable extent. In severe cases of neuralgia relief has been obtained by using cocaine or aconite or both with this method, when the current alone would not relieve. In many cases of tumors, glandular swellings, various skin diseases and syphilis, some of the iodine or lithia preparations and the bichloride of mercury have been used with good results, making applications with the aid of the galvanic current.

In using iodine it should be applied with the negative electrode, as it will be drawn toward the positive pole even against the action of the current.

One of the most beautiful as well as simple experiments for demonstrating and proving the electrical affinities of elements is the following:

Take a piece of blotting paper, moisten well with water, and place a small spot of pure tincture of iodine at about the center; next, close the galvanic circuit by placing the tip of the cord from the negative pole near the spot and the positive tip on the other side and a little farther away from the spot. In a few moments, (if the current be sufficiently strong) you will observe the spot of iodine to be gradually, clearly and bodily creeping or receding away from the negative pole and collecting around and under the tip of the positive pole, and indeed, if the current be continued for a sufficient length of time, the entire spot will be neatly and cleanly transferred from its original position, proving beyond doubt, that the element iodine has an electro-affinity for the positive, and is repelled by the negative pole, respectively. This fact has been made use of in medicine,

where an external application of iodine is indicated, its effectiveness may be increased ten-fold by first painting the part as usual with the tincture of iodine, or placing over it a cataphoric electrode filled with a saturated solution of potassium iodide, and placing the positive pole where its attracting influence will aid, and the negative pole directly over the painted or saturated part, then allowing the current to flow and thus the iodine is both drawn and driven, as it were, into the affected tissues. The pole selected will be according to the electrical affinity of the metal contained in the salt acted upon.

Which Pole to Use.

This question is often asked and is important to know in using medicine by cataphoresis. Every element is an *ion*, with either a positive or negative electrification. It is one law of electrification that like poles repel and unlike attract, so that if atoms are free to move, there is a double action going on, of attraction and repulsion, and if we know the relative affinity we can do good cataphoric work. Two elements may be of very unlike polarity, as sulphur and chlorine, which are highly negative *ions*, and potassium, sodium and lithium, which are the highest positive *ions*; therefore sulphate of morphine, and hydrochlorate of cocaine having a negative *attraction*, will be repelled by, and driven into the tissues by, the positive poles from which they are farthest removed, by *repulsion*. Likewise iodide of potassium being *attracted* by the positive would be best applied under the negative which would most *repel* it, for in cataphoresis, although attraction and repulsion are both

manifest, the *repulsion is the stronger*. A great deal of experiment has determined the relative position of the different elemental *ions*, and Berzelius's final series stands thus:

ELECTRO-NEGATIVE

Oxygen	Boron	Mercury	Thorium
Sulphur	Carbon	Silver	Zinconium
Selenium	Antimony	Copper	Aluminum
Nitrogen	Tellurium	Bismuth	Didymium
Fluorine	Tantalum	Tin	Lanthanum
Chlorine	Titanium	Lead	Yttrium
Bromine	Silicon	Cadmium	Glucinum
Iodine	Hydrogen	Cobalt	Magnesium
Phosphorus	Gold	Nickel	Calcium
Arsenic	Osmium	Iron	Strontium
Chromium	Indium	Zinc	Barium
Vanadium	Platinum	Manganese	Lithium
Molybdenum	Rhodium	Uranium	Sodium
Tungsten	Palladium	Cerium	Potassium

ELECTRO-POSITIVE.

At first glance the above statements and table would appear contradictory, but remember the Berzelius table is based on the attraction of the *ions*, and not the *repulsion* on which we depend most for cathodic effect, so that potassium being the highest negative *ion* is most attracted to the positive pole, therefore gets closest to it, and vice versa with oxygen and the negative. Change the poles and the *ions* would, if possible, all reverse their position on the list, metallic mercury being near the center, would not care much which way it went, but the oxy-chloride of mercury negatively *attracted* would be *repelled* most under the positive electrode. Two *ions* may be on same side of the neutral point, and partake of and be attracted by the same polarity, but would be mutually repellant, and the weaker would be pushed back,

just as two strong men will contend for the same prize but the stronger will overcome the weaker and keep him away from first place.

The drugs most used in electric cataphoresis, are the alkaloids, and halogen salts, the chief ones being cocaine and iodide of potash. Iodide of potash being very soluble easily carries the iodine into the tissues in a much less caustic form than iodine alone, and being higher in the scale than iodine, goes in faster and in greater quantity. Iodide of potash is also a very unstable salt; having only one bond of union, it is easily decomposed after it gets into the tissue, so that the iodine acts free within the tissues, and it is iodine we want in a rheumatic joint, and we can put in more in a local spot, by cataphoresis, than by the mouth, and do it more quickly, safely and pleasantly. Remember to apply *cocaine* and other *alkaloids* under the *positive* pole, and *iodide of potash* and other *halogen salts* under the *negative* pole.

CATALYSIS.

The passage of the electric current through the living tissues, has a direct and a reflex action upon the nutrition, both generally and locally, through the sympathetic and vaso-motor nervous system. The *positive* galvanic pole has the power to *contract* blood vessels, produce anaemia, and through the lessened blood supply *decrease nutrition* of a part.

The *negative* galvanic pole has the opposite effect, and will cause a *dilatation* of blood vessels

and a hyperaemia, with *increased nutrition* and absorption. Catalysis increases or diminishes nutrition and growth, promotes the absorption and removal of foreign or morbid growths or deposits, and being a physiological process is by far the most important property of electricity, and is the keystone of the entire system of electro-therapeutics. This property is manifest in all the forms of electrical energy, galvanic, faradic and static, and upon its thorough understanding and appreciation depends success.

We do not know *how* the electricity acts, but we know some of the laws governing its action and know that it never fails to produce the same results under the same conditions.

BATTERY CELLS.

If we place a piece of copper or carbon, and a piece of zinc, in a dilute solution of sulphuric acid, or a saturated solution of sal-ammoniac, the solution will have a different corrosive action on the two elements, and the one which is corroded the most, will have the highest potential, and, for convenience only, is called the plus or positive element, and the other one the minus or negative element. Experience has shown that the elements which are the most practical and economical to use are zinc and carbon. Zinc being readily corroded and carbon being non-corrosive, give us the best and widest difference of potential. There is a constant endeavor, like water seeking its level, to establish an equilibrium between the two elements,

and it is this phenomenon which gives us the galvanic current.

Inside the cell this current flows from zinc to carbon, while outside it flows in the opposite direction, to complete the circuit, or from carbon to zinc, so that the carbon which is negative inside the cell becomes the positive outside the cell, and vice versa, but we as physicians care nothing for the current inside the cell and only deal with the current outside the cell, so we must remember that the carbon element is our positive and the zinc, negative. There are many different forms of cells used in medical batteries, but only five which are in common use among physicians for generating galvanic currents.

Those most commonly used are:—1, The Le-Clanche; 2, Red Acid or Bichromate; 3, The Paste or so-called Dry Cell; 4, The Chloride of Silver Cell; 5, The Blue Stone or Crow Foot, or Gravity Cell.

Of the LeClanche there are two general forms with several modifications of each in use, viz:—The carbon cylinder form, and the porous cup form, but in medical batteries the latter is seldom used, while the former is nearly always preferred. The elements in both of these are zinc for the negative, and carbon and manganese binoxide for the positive, and the exciting solution in both forms is a saturated solution of ammonium chloride. In the carbon form the carbon and manganese are ground together and moulded in the form of a single or double cylinder, a fluted cylinder or a solid corrugated block. The zinc may be a single pencil or a sheet around the carbon. The larger the surface of the carbon and zinc exposed to the action of the excitant the greater the energy devel-

oped inside the cell and the larger the quantity of current produced outside.

The sal-ammoniac solution is used in many of the stationary office batteries, and makes one of the most constant and reliable batteries known. Four to five ounces of muriate of ammonia are placed in each cell and enough water to two-thirds fill the jar. The elements are carbon and zinc and these may be left immersed in the fluid when the battery is not in use. This cell is too large to be used in portable batteries.

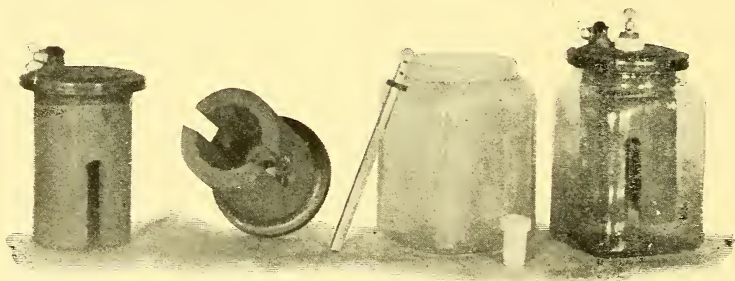


Figure No. 2.

The representative cylinder cell is the National No. 7, (see figure No. 2) a single cylinder cell. In this cell the zinc is a pencil placed inside the cylinder. In the use of cylinder cells a great amount of trouble has been experienced, due to the fact that the bushing used to suspend the zinc gives it sufficient play to come in contact with the inside of the carbon element, thus short circuiting the cell. This has been remedied in the National No. 7, (see figure No. 2) by using a special bushing, $\frac{3}{4}$ inch outside diameter, which allows no play, preventing possibility of short

circuiting the cells through the zinc and carbon elements coming in contact with each other.

The electro motive force of a fresh sal-ammoniac cell is about one and one-half volts per cell, no matter what is the size of the cell, as a cell the size of a gun cap will give as much voltage as one the size of a barrel, but the size of a cell makes a great deal of difference in the amperage or current strength.

The red acid or bichromate cell is the most commonly used for portable galvanic batteries when fluid batteries are desired. The elements are zinc, amalgamated with a coating of metallic mercury for the negative and carbon or platinum for the positive, although platinum is seldom used on account of its cost. The excitant is a solution of water and bichromate of potash or soda, to which is added one-tenth

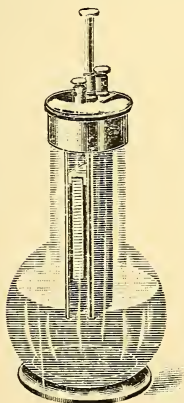


Figure No. 7.

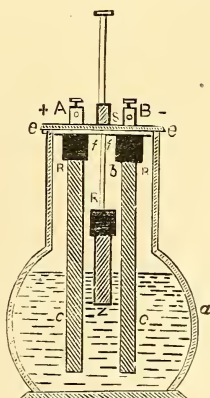


Figure No. 8.

part, by volume, of sulphuric acid. The containing vessel or jar is usually glass, porcelain or hard rubber. The acid cell furnishes a greater electro-motive force

or voltage than any other, being in a fresh cell about two volts per cell, and consequently will carry more current strength into the patient, as it will overcome more resistance than any other form of cell for medical use, but the acid cells are more filthy and expensive of renewal, as the zincs are corroded faster and the fluid requires more frequent changing. The solution corrodes the metal parts and if spilled in the box soon destroys it and whatever it touches.

The Grenet (see figures 7 and 8) cell, or some modification of it, is the one used for fluid portable batteries, and if carefully handled is safe and reliable.

The carbons being non-corrosive can be left in the acid solution, but the zincs must not be allowed to be in the fluid when not in use, as they will soon be destroyed and the fluid weakened. The zinc is first amalgamated by first dipping it into hydrochloric acid to free it from grease and oxide, and then rubbing on it with a cloth or brush, metallic mercury, until the zinc is covered with a coat of it, and it is best to put into the battery fluid some bi-sulphate of mercury in order to keep the zincs always amalgamated, which prolongs their life considerably. Amalgamation is not necessary or often applied to zincs in the sal-ammoniac cells.

In fluid cells there is internal decomposition of the fluid used, and by electrolysis hydrogen is liberated at the negative pole, which, inside the cell, is the carbon element, and if nothing was used to prevent it there would soon be a film of hydrogen gas covering the carbon element, which would insulate it and render the cell useless until removed. This could be done by shaking the cell or blowing air through the liquid, as is sometimes done, but the addition of the

binoxide of manganese to the sal-ammoniac cell carbon, and bichromate of potash or soda to the acid cell solution, prevents this formation of gas on the carbon, which is called polarization, therefore the addition of these substances, which are merely there as depolarizers, is very important.

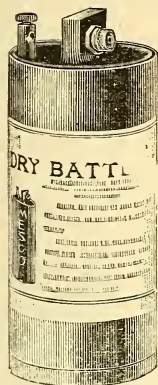


Figure No. 9.

The dry cell, so called, is really not a dry, but a paste cell, as the contents are a semi-liquid substance, but as it is small in quantity and is sealed, it is practically dry. The contents are so different that we will not attempt to describe them here, and the makes are varied, but the principle is the same in all, and this cell is only a modification of the Le-Clanche.

They all consist of a carbon plate, surrounded by some manganese, suspended within a zinc cup which forms the covering of the cell and filled in between with the semi-fluid paste which is the excitant, and the top is sealed with pitch or paraffine, and the outside is covered with paraffine, japan or paper. This cell is useful for portable batteries on account of its cleanliness, and is especially useful in small faradic batteries where only a few cells are needed, and where the cost of renewals is small, on account of being but few. Its principal objection is the cost for renewal, because when exhausted it must be replaced by a new one entire.

The ordinary dry cell is satisfactory for a portable faradic battery, but is too short lived and expensive and unreliable for galvanic work.

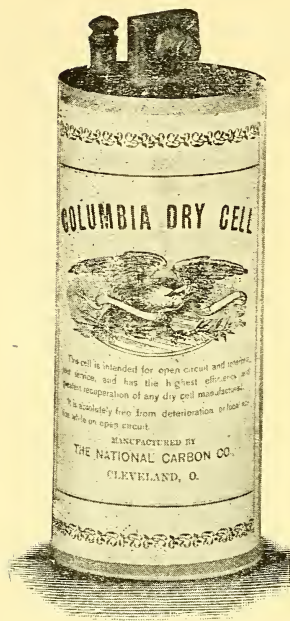


Figure No. 10.

1,000 milliamperes current.

The chloride of silver (see fig. 11) cell, is by far the most convenient cell, as it is a sealed cell, small and of sufficient quantity and current strength for all ordinary purposes.

The principal objection is its first cost, and the fact that it has to be returned to the manufacturers to be renewed. Elements are for the negative, zinc, and for the positive, a silver wire around which has been cast a body of chloride of silver. The solution is usually ammonium chloride, zinc-sulphate or caustic potash and soda. The makers claim for them: cleanliness, compactness, portability, convenience and readi-

The cell shown in fig. 9 is the typical form of the paste cell, and this cell has many names, and its use in galvanic practice has hitherto been very unsatisfactory, so that it is not to be recommended for galvanic electro-therapeutics extensively, unless one does not care for expenses. However, the makers of the Columbia (see fig. 10) cell, claim to have at last solved the problem, and offer a paste cell for galvanic work which will give satisfaction. If so "'tis a consummation devoutly to be wished" and "time will tell." In short circuit this cell gives about

ness of action, ease of renewal, constancy and uniformity of action, non-polarization, and the galvanic, a life of seven hundred, and the faradic one hundred working hours, and a cost of only $\frac{3}{4}$ of a cent per hour in use. A recent test of 10, 20, 30, 40, 50 new cells gave us 250 M. A. in short circuit, showing a uniform current strength, and as the fifty cells should give about 50 volts pressure, considering the small size of the cell, it is powerful enough for ordinary use. The cell cups are of glass (protected by a brass cover) and are only $1\frac{3}{8}$ by $3\frac{3}{8}$ inches, and each weighs $1\frac{5}{8}$ ounces. This cell is most valuable for portable batteries, as fifty of these cells will occupy only about as much space as two of the LeClanche, or sixteen of the small acid or paste cells.

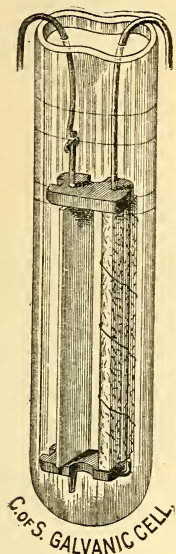


Figure No. 11.

The chloride of silver cell makes an excellent battery either faradic or galvanic; portable or stationary.

Gravity or crow foot cell (see fig. 12) is so well known that but a brief description is necessary. The cell is usually of glass for convenience of examination, at the bottom of which is placed a positive element of sheet copper in a solution of sulphate of copper, above which is placed the negative element, which is zinc in the shape of a crow foot, which hangs on the edge of the jar, and is immersed in a solution of sulphate of zinc which is poured into the jar on top of the copper solution without mixing. These cells are large, heavy, filthy and expensive, and are used only

where constant voltage is essential and small current need, requiring few cells, and about all the use physicians have for them is to keep storage batteries constantly charged, which they will do very well.

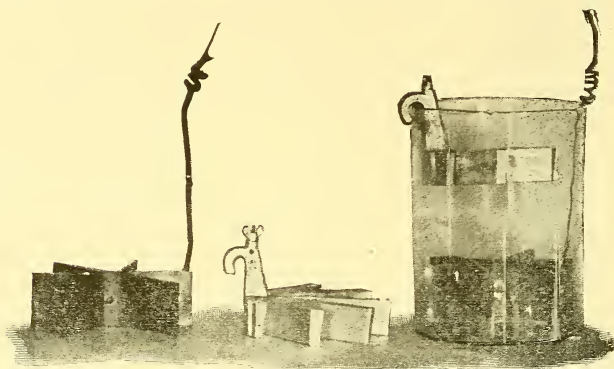


Figure No. 12.

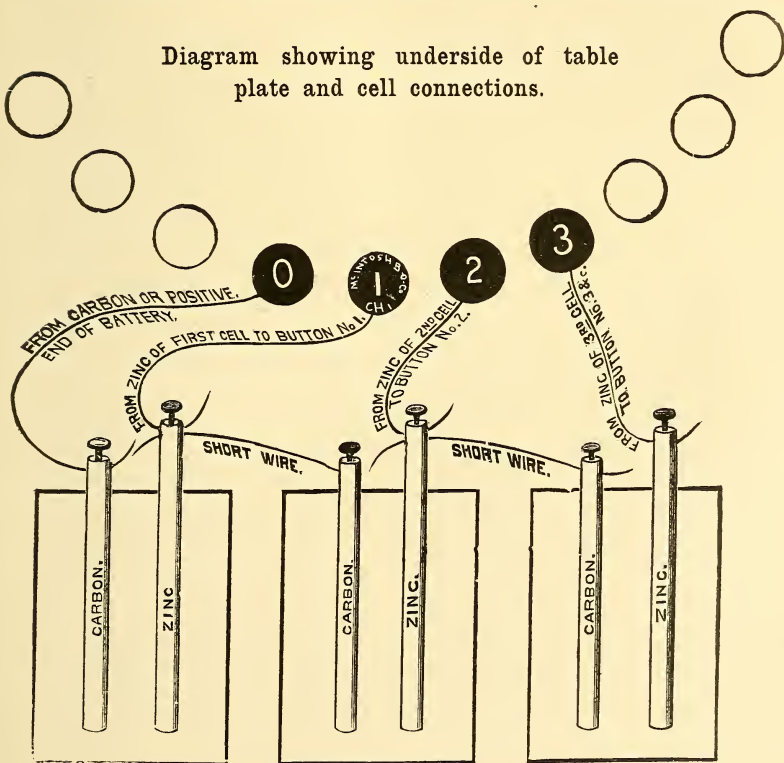
Some form of the LeClanche cell is the one most in use for electro-therapeutics, as it is easily and cheaply recharged, and is not as filthy as the acid cell, but on account of its size and weight it cannot be used for portable batteries and its use is therefore confined to office work.

In selecting a cell due consideration should be given to the service it will be called upon to perform. This may be divided into two general classes, viz:—open and closed circuit; open circuit being where a battery is thrown in circuit for a short time only, and having a period of rest between each time of use during which interval it will recuperate; closed circuit, where a battery must deliver current for a considerable length of time, such as fan motors, small incandescent lamps, prolonged treatments, such as in tu-

mors, and electrolysis and cataphoresis, etc. For all ordinary work, such as is done by the general practitioner, the carbon cylinder type, the National No. 7 (see fig. No. 2) cell will answer this purpose well.

The cells of a physician's office battery should be arranged and connected according to the following:—

Diagram showing underside of table plate and cell connections.



This diagram, showing cells and connections, does not refer to any particular cell, but is intended to show how to connect the negative and positive elements of any form of cells in series, and with the table plate.

Directions for Setting Up and Charging Galvanic Cells.

Charging the Cells: Fill each jar two-thirds full of clean water, add a package (4 oz.) of sal-ammoniac; stir with a stick of wood until all the salt is dissolved. Place the carbon and zinc in the jar, being careful not to get the fluid on the outside of cell or connections.

Connecting the Cells: Place the cells in a cabinet, or on shelves, as desired, then connect zinc of first cell by means of a short wire, with the carbon of next, and so on until all are connected; (that is, zinc to carbon; zinc to carbon; zinc to carbon) and so on, until all are connected in a continuous chain. Do not connect zinc of last cell to carbon of the first. See diagram of under side of table plate and cell connections on page 45.

To Connect the Cells with the Table Plate.

Galvanic: Take the number of cells you wish to use for galvanic and put them in their place and connect them with short wires as above, till all are connected in series. Then connect wire No. 0 from large cable to carbon of first cell, wire No. 1 to zinc of first cell, and continue till all are connected. Then there will be two wires fastened to zincs of all cells but the last. Remove the cell selector cap when not in use, as that takes place of the "off" button. Any number of cells can be used with this circle by skipping cells with the wires to buttons, thus putting 2, 3, or 5 cells to a button, if desired. When connected thus, the 0 wire will be positive, and 1, 2, 3, etc., will be negative.

Faradic: Connect the same way; but use only four cells and wires from small cable.

Electropoion—Formula.

To make the battery fluid: $\mathcal{R}$ Sulphuric acid, (commercial) 3 fluid oz.; Powd. Bichromate of Potass., 2 oz.; Water, 16 fluid oz.; Bisulphate of Mercury, 2 dr. Dissolve the Bisulphate of Mercury in the water, then add the Bichromate of Potass. When dissolved, pour in the Sulphuric Acid slowly, stirring with a stick and allow the liquid to cool, as the mingling of the acid and water produces heat, and if the mixture is used when warm it injures the battery.*

The bisulphate of mercury keeps the zincs well amalgamated.

Mix and keep in a glass or earthen vessel or jug, in a cool place.

There is a preparation on the market known as Chromac, which is just the thing for quick and safe preparation of acid bichromate solution. It is in a coarse granular form, put up in pound or pint Mason glass screw top jars, which can be used again. All that is needed is the addition of water, and is ready for use in ten minutes.

One pound makes two quarts of the standard battery fluid, and it costs about the same as the other fluid and is much easier to prepare.

*NOTE.—If you can obtain bichromate of soda, it will be advantageous to use 3 oz. of bichromate of soda instead of 2 oz. of bichromate of potash, as the bichromate of soda makes a stronger and better fluid; and by the use of this formula, your cells will be kept free from the annoying deposits of chrome alum crystals.

What is a Storage Battery?

We have been asked by several students the above question, and several others have asked us if

storage batteries could be used for electrolysis. To the last question we answer that it could, but owing to the number required and the expense, they are seldom, if ever, used for that purpose. For the information of those, or any others, asking the first question, we will say that a storage battery so-called, does not store electricity any more than any other cell, but it accumulates energy which will generate a current. In an ordinary galvanic cell there are two elements of different composition, immersed in a solution called an electrolyte, which will have more chemical action on one element than the other, so that there is a difference of potential, and if these elements are connected by a wire there will be a current running through it, from the higher to the lower potential, the same as water runs down hill. The storage battery is usually made of plates of lead immersed in dilute sulphuric acid (H_2SO_4). These plates of lead having the same composition, will be acted upon equally, and having the same potential, will not generate any current of electricity. If now we pass through this cell a current of electricity, from some outside generator, it will set up a chemical action, which will be different on each plate. For instance, place plates 1 and 2 in a solution of sulphuric acid and pass a current through it, there will be a chemical decomposition of the solution, and oxygen will be set free at the positive end (1), which (O) will combine with the lead (Pb) making a new compound, lead oxide (PbO), which has a higher potential than the plate (2) which is a spongy metallic lead (Pb). This is called "forming" the plates and "charging" the cell. Now we have a cell with two different elements in a solution, which will act on them differently, and

have a cell which will generate a current of electricity, but in the opposite direction. Now, the acid will act on both plates and there will be generated a current, and one atom of oxygen will be taken from the plate 1, which is PbO , and transferred to plate 2, which is Pb , and this will continue till they are both equal or PbO , when the current will no longer be generated because the elements are again similar. Then the same process of "charging" must be repeated. Of course there are many modifications of this plan, but this is, in brief, the method of working the storage cell. The fact that electricity must be first passed through it, gives it the name "storage," but only chemical energy is developed and not a storing of electricity, and this chemical energy follows the law of physics that says "for every action there is always an opposite and equal reaction," and the electricity generated in the storage cell after it is formed, comes out of it in the opposite direction to which it went in. If the plate 1 is positive with the charging current, it will be positive with secondary current. A storage cell has a potential of two volts, and this potential does not depend on the size of the cell, but on the kind of elements, and the kind of solution, while the current strength or amperage depends on the size of the elements exposed to the solution.

The elements in a large cell are larger than in a small cell, hence the more surface corroded and the greater the difference of potential and current strength.

Other things being equal, a cell the size of a gun cap will have the same voltage as one the size of a barrel, but the amperage will be very much different.

GENERAL FARADIZATION.

General faradization, as its name implies, is general use of the faradic current. The treatment has a direct influence upon the entire system and by reflex action may indirectly have a therapeutic effect on some particular organ or part which may be diseased. General faradization is indicated wherever a general constitutional tonic influence is called for, in conditions of depressed vitality, in tedious periods of convalescence, wherever there is poor circulation, defective assimilation and in nearly all nervous conditions.

General faradization is given by placing one electrode—usually the negative—at the lumbar plexus of nerves, or upon the sternum, or at the feet—preferably the latter—and passing the electrode all over the surface of the body.

It is best to begin treatment of general faradization with the positive pole at the base of the brain, pass it slowly down the spinal cord for three to five minutes, then pass it over the chest and hold over the epigastrium for a few minutes to influence the coeliac plexus, then over the abdomen to stimulate intestinal action and the abdominal muscles, then upon the thighs, arms and legs, varying the strength of current to suit the resistance offered by the different parts.

In giving faradization it is important that treatment should not be neglected at the back of the head, down the neck, the upper portion of the spinal column, and over the cilio-spinal center. The most important nerves of the body can be treated here. The

length of treatment should be from fifteen to twenty minutes, and may be given every day or every other day.

GENERAL GALVANIZATION.

General galvanization is applied the same way as faradization, using the galvanic current.

GALVANIZATION OF THE BRAIN.

The galvanic current only is of service in treating the brain. The current may be passed transversely, longitudinally, or diagonally through the brain. The electrodes should be from one to one and a half inches in diameter.

If the positive pole be applied to the back of the neck and the negative pole applied to the forehead the flow of blood to the head will be increased.

If the position of the poles be reversed the supply of blood will be diminished.

Treatments should not be continued more than from three to five minutes. Mild currents only must be used. The current should not be interrupted or reversed.

Galvanization of the brain is indicated in various cerebral and nervous diseases among which may be mentioned headache, insomnia, melancholia, exhaustion, cerebral hyperaemia and anaemia, hemiplegia of cerebral origin, epilepsy, insanity, etc. In some cases, lesions, effusions, infiltrations, etc., are materially benefitted.

CENTRAL GALVANIZATION.

By this we mean a treatment with the galvanic current which will bring the entire central nervous system—the brain, sympathetic and spinal cord—under the direct influence of the galvanic current. This treatment is given by having one pole, usually the negative, at the epigastrium and the other at the vertex, or passed over the forehead, down the back of the neck and down the entire length of the spine. Having the negative pole at the epigastrium and the positive at the base of the brain, and down the sides of the neck, is the best method of stimulating the sympathetic, pneumogastric and phrenic nerves.

Avoid sudden interruptions of the current. Mild currents must be used. One to four cells or one to five milliamperes will be sufficient through the head. Down the spine the strength of current may be increased. Seances should be brief—three to ten minutes. Central galvanization is one of the most valuable treatments in nearly all diseases of the nervous system.

GALVANO—PUNCTURE.

The use of the needle is frequently necessary in treating epithelioma, hydrocele, hemorrhoids, cancers, small growths and in some cases of goitre and other tumors. The negative pole is usually used. From four to eight cells or from ten to fifty milliam-

peres are sufficient, except in large tumors. The positive electrode should cover a large surface upon some in different part. The current strength should be gradually increased, carefully avoiding interruptions and reversals of the current. Treatment should not be continued more than two to ten minutes and should not be repeated more than once or twice a week. Sometimes needles attached to both poles of the battery can be used in the same growth, in which instance the needles attached to the positive pole must be of some non-corrosive metal, such as gold, iridio-platinum or aluminum. Puncture in uterine or ovarian tumors is no longer practiced on account of the danger of sepsis.

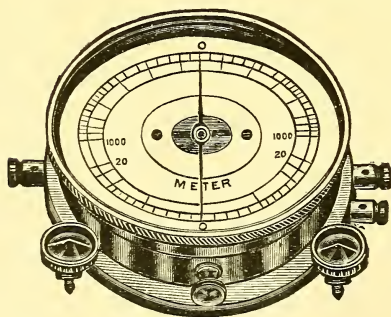
A FEW SUGGESTIONS ON USE OF THE BATTERY, AND MILLIAMPERE METER.

In the use of electricity for any purpose, the question of resistance comes up at every step, and must be considered by the physician in every operation in which he uses this agent in therapeutics. To many, the following suggestions are well understood, but are appreciable to those who have not given much study to physical electricity. It is also to answer the question, which is many times daily asked, "How many milliamperes will my battery give me?" or, "You sold me a battery and told me it would give 200 milliamperes or 100 milliamperes; now I have tried it with all my cells turned on, with one electrode in each hand, and I find it only registers about 5 milliamperes. What is the matter? Where is my 200 milliamperes to come from?"

Many of these questions are asked unadvisedly, and would never be given utterance did the speaker, or writer, give them due consideration; as for instance, it is quite a common occurrence for a bright and intelligent-looking customer to enter a salesroom, and, pointing to a microscope (without objective in it), remark, "What is the power of that instrument?" Or, "How many diameters does it magnify?" and when he is told that it all depends upon the objective and eyepiece, he sees it at once, and says, "Oh, yes."

In order to answer the question, which is many times asked: "How many milliamperes will my battery give me?" and to show you that such a question means nothing, we will call your attention to Ohm's law:—

$$\text{CURRENT} = \frac{\text{Voltage}}{\text{Resistance,}} \text{ or } C = \frac{E}{C}.$$



Milliampere Meter.

Now, there is just as much reason in asking how many diameters a microscope will magnify, as how many milliamperes a battery will give. But, to make the matter more plain, we will say:

First. The amount your milliampere meter registers depends altogether on the amount of *resistance* in the circuit.

Second. With one electrode in each hand, and the entire 30 or 40 cells turned on, your milliampere meter would probably only register about 5 or 10 mil-

liamperes. Why? Because the resistance of the whole human body is in the circuit. This varies in different individuals from 5000 to 10000 ohms. therefore, 5 milliamperes would indicate a very good current.

Third. In the Apostoli method of removing fibroid tumors of the uterus, with the same number of cells in circuit, as above; with one large electrode upon the abdomen, and working within the uterus, upon a mucous surface, your resistance would be reduced to a minimum, and you would get with this same number of cells, about 150 to 250 milliamperes. Why is this? Because there is only about 150 ohms resistance in the circuit.

Fourth. Turn on about 10 cells of a galvanic current, with the milliampere meter in circuit, and place the cord-tips on your tongue and see what your meter registers. (Low resistance.)

Fifth. Place the cord-tips in a piece of raw meat and see what your meter will register with a few cells. (Little resistance.)

Sixth. One single cell with *no resistance* gives about 1000 milliamperes.

Seventh. Never attempt to give a patient 100 to 200 milliamperes through the body, even if you have the cells to produce it, because it might produce death.

Eighth. The human body has double the resistance of the *entire Atlantic cable*.

Ninth. The human skin is a very high resistance surface.

The *larger* the surface of the electrodes the less the resistance and consequently *the more your meter will register*.

Lastly, mucous surfaces give very low resistance. You will have no trouble having your milliamperemeter register 200 milliamperes with 25 to 30 good chloride of ammonium cells in circuit, in removing fibroid tumors of the uterus; because they are not treated by passing the current through the body from one hand to the other.

If, during an operation, your milliamperemeter does not give you the amperage you think it should, do not say the milliamperemeter is wrong and cast it aside, but look for the fault some place else. Possibly your cords are faulty; this is a frequent occurrence, and should be looked into every time; or, some of the connections are not made properly. Look your battery all over, try it with wires instead of cords, and if it does not work right, the fault then should be remedied by some one who is skilled in repairing these instruments.

Do not bring the cord-tips or electrodes in contact when using a galvanic current with the meter in circuit. It may injure the meter. (Short Circuit.)

Do not expect to get a galvanic current when the current selector is on "P" or "S," or a faradic current when the selector is on "G."

The National Switchboard.

The following cut represents a fine switchboard. The base is made of polished slate or variegated marble (dark) and is 12x20 inches in size. There are many advantages of this marble or slate over wood or hard rubber for switchboard work:

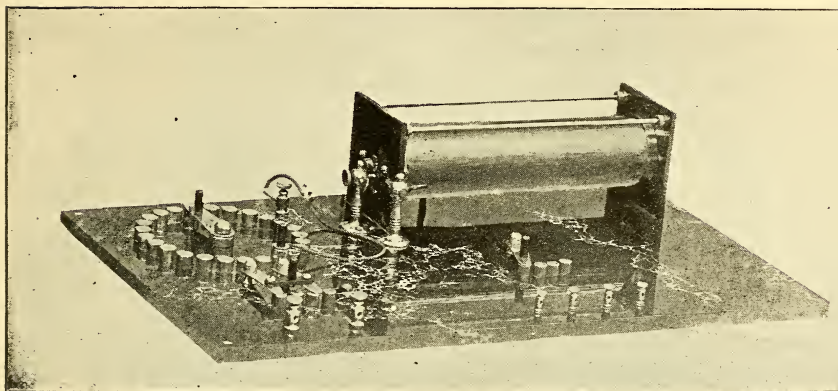
1st. The marble or slate presents a much nicer appearance.

2nd. It will not warp when subjected to heat or moisture.

3rd. It is not discolored or otherwise injured by spilling water, acids or medicines upon it.

4th. It will not crack or check after a few months use.

5th. It is more durable and substantial.



This switchboard is arranged for twenty-five cells galvanic and four cells faradic. (The No. 7 sal-ammoniac cells are the best to use with this form of battery, although any other form of wet or dry cells, except the silver, can be used with it). It has a cell selector, commutator (or pole changer), a switch to throw on any number of cells and the usual binding posts. All metal parts are nickel plated. The coil is a high tension coil containing 3200 feet of wire, tapped at various lengths, so that almost any desired length of wire can be used, as follows:

Posts 1 and 2 gives primary current from 200 feet No. 20 wire.

Posts 2 and 3 gives coarse secondary from 1200 feet of No. 32 wire.

Posts 3 and 4 gives fine secondary from 1800 feet No. 36 wire.

Posts 2 and 4 gives all of secondary from 3000 feet of wire.

Posts 1 and 4 gives entire coil, 3200 feet of wire.

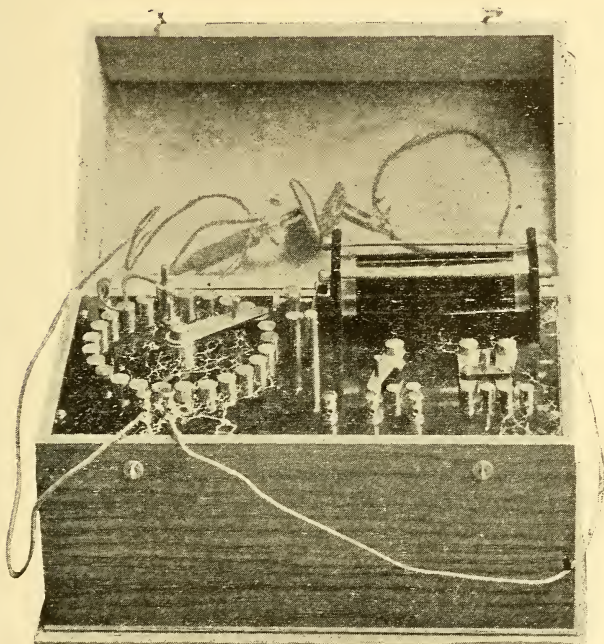
All connections are made beneath the switchboard, which can be immediately connected to the cells. There are no parts to get out of order. The entire switchboard will last a life time.

Space is left on the board for a rheostat and milli-ampere meter, and these may be added at any time. The switchboard is arranged to be placed upon a table, commode, stand or other piece of furniture, and the cells may be beneath or in an adjoining room. Any additional number of cells may be added, by connecting two or more cells to each button.

Where beauty, durability, convenience, quality and quantity of current strength, with greatest economy of space and money is considered, this form of switchboard is the one to select, as it contains all the essentials for the beginner, and additions can be made at any time to make it more complete and elaborate.

The following cut shows a late design of portable combination galvanic and faradic battery, which is a miniature of the larger combination switchboard for a stationary office cabinet shown on a preceding page. It has a circle of buttons, with switch and cell selector, pole changer and binding posts for twenty-four, four-inch Columbia dry cells, for the galvanic part and a medium length induction coil, switch and binding posts and two dry cells for the faradic part. All metal parts are of solid brass, nickel plated, and mounted

on a marble plate, and all inclosed in handsome quarter-sawed oak case with brass or nickel trim-



mings. The whole weighs only twenty-five pounds. Where compactness, cleanliness, convenience and portability are most considered, this form of battery is a good selection.

"RHEOSTATS."

The use of the Rheostat is to modify the intensity of a current of electricity by passing it through water, coils of wire, or other resistance media.

A rheostat which will permit of a gentle and gradual admission of the current into the circuit, after the electrodes are in place, up to the strength and voltage required, maintaining it there without fluctuation, and when the work is done, permitting a like gentle and gradual withdrawal of the current, is the most essential factor in the series of electric applications.

The question as to what form of rheostat is required by a physician practicing electro-therapeutics can be answered only by knowing the nature of the current he is intending to use and for what purpose he uses it. A rheostat to be used for modifying and controlling the large currents employed for cautery work must have a very different structure and current carrying capacity from one that is to be used to modify the weaker currents that traverse the body. The former needs but small resistance, but large capacity, for carrying current without heating; the latter must have a wide range of resistance and requires but little current carrying capacity.

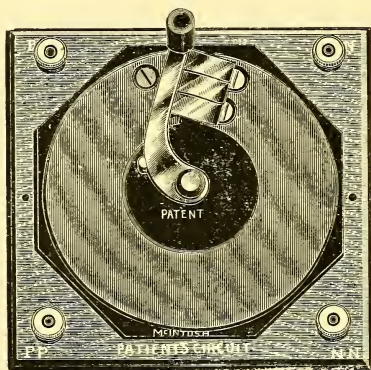
In treatments where the current traverses the body, it is seldom that more than 150 ma. of current is required. If the source of this current is a battery of cells in series giving an electromotive force of 50 volts, the combined resistance in the body and in the rheostat must not exceed 333 ohms if the current is to reach 150 ma. But if the current needed is but 5 ma. and the same battery is used, then the combined resistance of body and rheostat must be as much as 10,000 ohms. This is a very wide range of resistance, most of which must be provided for in the rheostat, since the body resistance is too uncertain a quantity to depend upon. The current in these cases is, at the greatest, so small that such a rheostat could be made

of very fine resistance wire, as No. 36 to No. 40, German silver. German silver or other resistance wire is needed where extreme accuracy is required, and it is important to know exactly how much resistance is at any one moment added to or withdrawn from the circuit. Its resistance is constant, and a long coil of such wire tapped at known intervals and marked with the amount of resistance each segment gives makes the best form of rheostat. But rheostats composed of spools of German silver wire are objectionable because of their cost, and because it is utterly impossible to increase or decrease the resistance in passing from spool to spool without these successive steps in variation of resistance being manifested by the flutter of the needle of the milliamperemeter, and the painful sensation to the patient. Since the thing of chief importance in this kind of electro-therapeutic work is to know the amount of current, any material can be used in a rheostat, which will meet this need, and which serves to keep the current at the required amount, and can furnish a sufficient range of resistance to provide for a change, with a fairly uniform gradation, in the amount of current when it is desired.

Rheostats composed of water in a suitable receptacle will do this, and many good water rheostats are in use. But if any metal except gold or platinum enters into the construction of a water rheostat it is soon corroded, and the corrosion takes place more quickly when the electrolytic action of the current is added. The water evaporates and needs to be replenished, and the receptacles for the water are usually made of glass and are easily broken.

The use of platinum plates in the rheostat makes the cost of the instrument prohibitory when close

economy must be considered. Every form of water rheostat employing carbon plates is condemned by the very rapid disintegration of the plates and connections, by the electrolytic action.

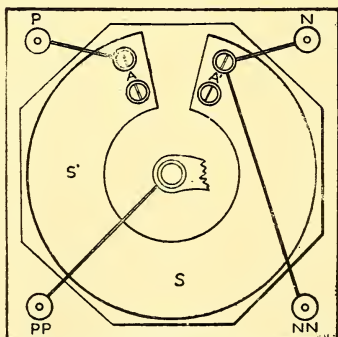


Graphite Rheostat.

Graphite current controllers, heretofore offered, have been objectionable from the fact that the graphite surface was laid on by rubbing with a graphite pencil; hence the resistance material was not evenly distributed, and was so rapidly removed in use as to require constant repairs; furthermore, the graphite so applied is subject also to the injurious effects of moisture.

For cautery work and lighting lamps the rheostat has to deal with very different conditions. A current of from $\frac{1}{2}$ to $1\frac{1}{2}$ amperes is required for lighting lamps, and for a full line of cautery instruments a current of from 1 to 30 amperes is needed. The resistance to be overcome is, in both cautery burners and

Graphite current controllers, heretofore offered, have been objectionable from the fact that the graphite surface was laid on by rubbing with a graphite pencil; hence the re-



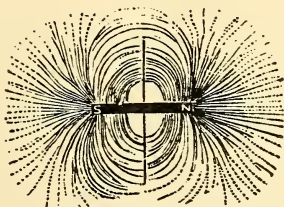
Plan of wiring a Graphite Rheostat in Shunt, for use with the incandescent current.

lamps, very small, compared with the resistances in the body.

Should an attempt be made by means of a rheostat to get from a dynamo current of 100 volts a current suitable for cautery work, the rheostat, if arranged to modify the current by introducing more or less resistance directly into the circuit with the cautery burner, need have no more than 100 ohms resistance in order to reduce the current to as little as one ampere, and to do the same with the 500-volt circuit the rheostat need contain but 500 ohms resistance. But the wire rheostat that would give even this amount of resistance and at the same time be made of wire large enough to safely carry the current required by most cauteries (5 to 20 amperes) would need to be made of such large wire and would take so much of it as to be too unwieldy and expensive to be practicable. No such difficulty would attend the construction of a rheostat for lighting lamps from these dynamo currents, however, for the amount of current needed is much less.



Primary and Core of an Induction Coil.



Magnetic field showing lines of force around core or magnet.

"COMMERCIAL CURRENTS IN ELECTRO-THERAPEUTICS."

There is no essential difference between the Edison 110 volt current or any other constant current generated by a dynamo, and the current generated by chemical action, in any of the various forms of galvanic cells. Either of these currents will exert precisely the same electrolytic action, but while there is no essential difference in the quality of the current, there is a very material difference in the voltage and amperage, thus 36 cells of zinc carbon bi-chromate battery will show E. M. F. of 72 volts and 5000 milliamperes on short circuit, and 36 chloride of ammonium cells will show E. M. F. of 54 volts and 1000 milliamperes on short circuit. The Edison current passing through a 16 candle power lamp will show a little less than 110 volts and 500 milliamperes. For electrotherapeutic effects very low amperage, from 3 or 4 milliamperes up to 100 or a little more is all that is desired, the volume of the current depending upon the character of the work to be performed; but the human body being a very high resisting medium the voltage required will depend entirely upon the character of the tissues through which the current is to be passed.

All dynamos do not furnish a current that is of the nature of a galvanic current. Many of the incandescent light dynamos generate "to and fro" or alternating currents, and such currents, while they have physiological and therapeutical effects peculiar to

themselves and are very useful in the treatment of many ailments, do not do the work of a constant galvanic current, such as electrolysis, or cataphoresis. Again, many physicians who would gladly avail themselves of electro-therapeutic helps, are located out of range of all commercial currents, and must, if they use electricity at all, depend upon chemical sources of generation for galvanic currents, such as bichromate of potash, chloride of ammonium, or some other form of primary battery.

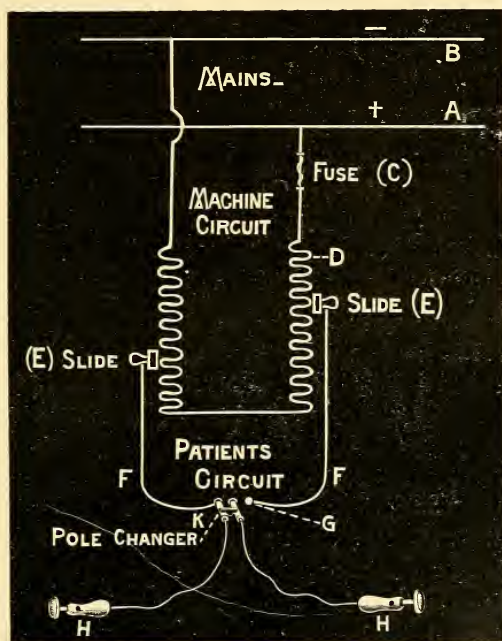
The zinc carbon bichromate cell, or the various forms of chloride of ammonium cells are no sooner brought into action than the current begins rapidly to weaken, due to polarization, consequently they are only adapted to such electrolytic work as will occupy but a few minutes of time. The Edison, or a current from any constant current dynamo, continues to flow with almost unvarying uniformity through as many minutes or hours as it may be desired to use it. Why then, should it not be the most desirable current for the use of every physician who may have access to it in his office? The great difficulty in using this class of current lays with the rheostat for controlling it. All the rheostats on the market, with the exception of one, which we shall mention later, whether wire, water or graphite, has the fatal physical fault of reducing the amperage of the current in a much greater ratio than it does the voltage or E. M. F. It is an easy matter, therefore, to reduce any current by means of any of these various rheostats to as low as one (1) or two (2) milliamperes such as we might wish for very delicate subcutaneous work, but in reducing the current to the desired few number of milliamperes we have not proportionately reduced the voltage, conse-

quently, while we have current sufficient to perform the desired work, and with which we should be able to perform that desired work without inconvenience or pain to the patient, we are unable to avoid the painful effect because we have not been able to get rid of our E. M. F.

This objection to the various forms of rheostat which have been offered, applies not only to the rheostats which are offered for the control of the Edison current, but operates with equal force in their use to control the current from a battery of cells connected in series and the current from the entire battery controlled through the rheostat.

It is for this reason that we strenuously advocate the use of the various designs of switchboard controlling the number of cells in action by means of the double selector switch, by which the physician is enabled to use a small number of cells with a correspondingly low E. M. F. for delicate electrolytic work, and introducing the large number of cells with the higher voltage only when the resistance to be overcome requires calling into effect the higher tension of current; but we have long realized the importance of a current controller which would enable the physician to use with certainty and with safety the various commercial currents, which from day to day are becoming more accessible to him in practice. Out of this urgent need, and with a full understanding of the difficulties to be overcome and a full knowledge of the fact that others have failed to overcome these difficulties, the current controller has been designed. This instrument is not a rheostat, but is in strict parlance just what its name indicates—a current controller. It is free from the danger of all forms of rheo-

stat at present on the market, since the utmost current passing through the controller is 500 milliamperes. This current enters the instrument with an E. M. F. of about 110 volts. It is constructed so as to increase or decrease the voltage or E. M. F. and current in a decimal ratio by a simple sliding motion of the contact along a clearly marked scale.



Shunt Incandescent Current Controller.

It possesses the very great advantage over the ordinary rheostat in that it is a current controller perfectly adapted for use on the commercial current or

on a battery of LeClanche or storage cells. The original voltage from any one of these sources being known, the pressure employed at any instant can be readily determined. The manner in which the current controller performs its work has been satisfactorily tested. The extensive experiments to thoroughly perfect its work have been carefully performed under the most competent guidance in the Electro-Therapeutic Laboratory of the University of Michigan at Ann Arbor. The desirability of the commercial current over the battery current when the practitioner can feel that he has at his command a perfectly safe and reliable current controller must be manifest from the fact that the commercial current is at the disposal of the operator at any moment and during any desired continuance of his work at nearly uniform voltage, and thus placing within his control a condition of uniformity which cannot be reached from any form of chemical battery. There have been many rheostats devised for regulating the constant current for therapeutic work, but so far as we know there has been no attempt made to control the alternating current except for galvano-cautery. The current controller enables the physiological and therapeutic effects of the alternating current to be utilized. This alternating dynamo current is the only perfect form of sinusoidal or true "Harmonic Wave" current—so highly lauded by the most eminent electro-theraputists for its anaesthetic and analgesic qualities.

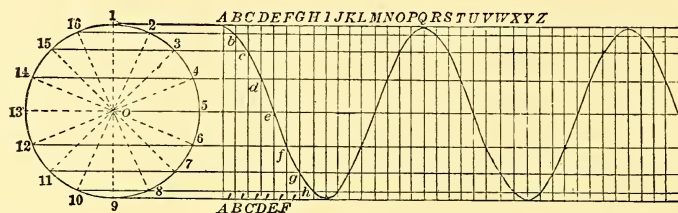
We believe the day is not far distant when the powerful vaso-motor effects of this peculiarly valuable current will be very generally utilized through the aid of the current controller.

THE SINUSOIDAL CURRENT.

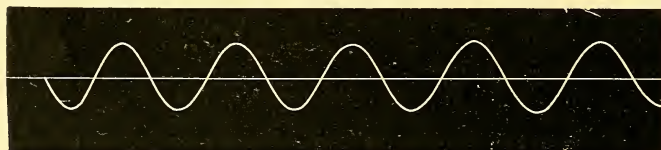
The sinusoidal current referred to on preceding page was simultaneously discovered by Kellogg in America, and D'Arsonval in France. It is an alternating current, generated by induction, in an armature, or coil of wire, which is rapidly revolved within the magnetic field of another coil and core, (see cut on page 63). In the ordinary induction coil (see pages 13, 14, 15,) the exciting or inducing current is interrupted in the primary circuit, by means of the vibrator spring and hammer, which acts like a pendulum swinging to and fro on each side of the center, and when it reaches its maximum on either side, it of course, has to stop before starting back, thus making a dead point at which it goes neither way, constituting the "make and break" of the induced current in the secondary coil.

During this rise and fall of the induced current no sensation is felt, as it is a constant flowing in one direction, as is the galvanic current, but when it is interrupted at the dead points, or "make and break," then, as in the interrupted galvanic current, a shock is felt, which is painful, and causes contraction of muscles. In the sinusoidal current, induced in an armature which is revolving in a circle, and making a revolution back to the starting point always in the same direction, and not stopping to swing back, as the pendulum vibrator does, there is consequently no dead point, and the "make and break" is not felt painfully or with any shock. This produces a sinuous or har-

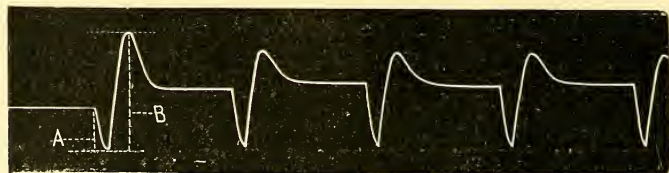
monic wave-like contraction, and a soothing or pleasant sensation, relieving pain and often producing anaesthesia.



The above diagram gives a graphic idea of the wave-like impulse imparted, and of the idea of the complete circular revolution marked in the left, if you can imagine yourself looking through the end of a spiral coil of wire.



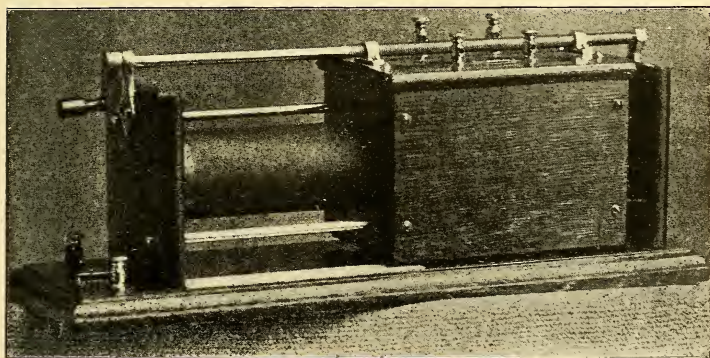
The above cut illustrates the same thing more plainly, showing the smooth impulse both above and below the neutral point, between positive above the line and negative below.



The above cut illustrates the abrupt rise and fall of potential, with the dead point, or "make and break"

of the to and fro, or pendulum motion, of the vibrator in the ordinary faradic coil.

This current can be secured from any apparatus having a permanent magnet, or any coil having a temporary magnet. The rapidity of the revolutions of the armature, as is the case in the rapidity of the vibrations of the hammer in the induction coil, (see pages 13, 14, 15,) determines the character of the sinusoidal current. It is best generated by an apparatus with an armature turned by an electric motor, in order to get the greatest speed and most regular and rapid sine curves, or waves. This current cannot be as generally used as it should be, on account of the



Potential Controller or Transformer, for use with the alternating incandescent current, for sinusoidal, cauterizing, and diagnostic work, with small lamps.

lack of above facilities, and cost of apparatus. Like the high tension faradic induced alternating current it has great voltage and low amperage and relieves pain and produces anaesthesia by causing a temporary paralysis, or tetanization of the nerve, while the

positive galvanic does the same thing by its inherent soothing and sedative properties of catalysis.

The ordinary alternating street current, when run through a step down transformer, to reduce the current strength gives a sinusoidal current, and the old-fashioned magneto-electric machines, run by a hand crank, give a very coarse and rough demonstration of the same thing. The indications for the sinusoidal current are the same as for the high tension faradic induced current, to which, in many respects it is far superior, because more pleasant and not as painful.

THE ROENTGEN OR X-RAYS.

The Roentgen rays are so named from their discoverer, William Conrad Roentgen, a professor in the University of Wurzburg, Bavaria, in 1896. Columbus was not the first to discover America, but he was the first to put the discovery to any good use. Roentgen was not the first to observe the phenomena of the ray which bears his name, but he was the first to utilize the discovery. Years before, other eminent physicists had observed the phenomena, and considered them to be interesting and curious, but of no practical value.

Roentgen announced his observations, and since then others have discovered the rays numerous times, but no one as yet has either added to or taken from the observations of Roentgen. He found that this new or hitherto unknown light or ray would penetrate

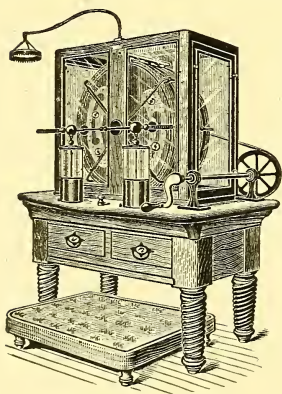
substances which were opaque to ordinary light, as flesh, bone, wood and thin metals, but would not penetrate glass which is transparent to sunlight. He also found that they were given off from the outside of a vacuum tube at right angles to the surface and went straight to infinity, and could neither be deflected or reflected, or changed from their course by a magnet. He also found that they would affect the film of a sensitized photographic plate, and that shadows of varying density would thereby be fixed, so that bones, foreign bodies, and abnormalities, concealed by the flesh or in opaque substances could be detected.

Having no name for this new light, and it being an unknown quantity he gave it the indefinite name of X-ray, by which it is known today. Various theories have been advanced, but they are foreign to this work now. The generally accepted idea of the X-ray is that it is a form of radiant light the vibrations of which are so rapid as not to be detected by the human eye, and that this light is somewhere beyond the violet rays of the solar spectrum, hence they are called the ultra-violet rays. Some people who have been blinded to ordinary light for years, but whose optic nerves are preserved, have a vision acute enough to detect the ultra-violet light which penetrates the veil of their vision, and touches the hyper-sensitive nerve.

These rays can be generated by the simple or Ruhmkorff induction coil, or by the compound or Tesla induction coil, or by the high tension static influence or induction machine. These rays seem to have an action or effect on healthy tissues, which may be either harmless or harmful, but it is not known whether it is due to a mechanical cataphoric, or a chemical property, but it certainly does cause an

irritation of the skin and tissues, known as X-ray burn or dermatitis, which is hard to heal.

The rays generated by coils seem to be more severe and have a more irritant or burning action than those generated by static machines, but with careful operators using antiseptic precautions, and short exposures, there is little danger of a burn. The coils are more portable, but are expensive, filthy, and can not be used for anything else, while the static machine, although not as portable, has many other uses in therapeutics and is the safest and best means of generating X-rays. The accompanying cut shows a modern static or influence machine which is useful for all purposes set forth in the preceding pages (16-25) as well as for the X-rays.

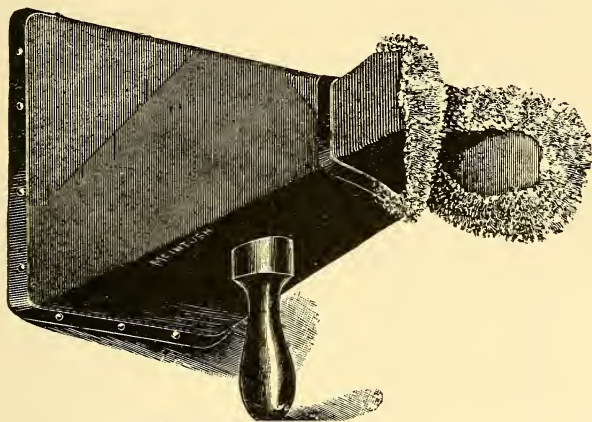


Static Machine.

The X-rays have the property of causing certain chemicals to take on a whitish appearance known as phosphorescence. The most commonly used of these chemicals are tungstate of calcium and bario-platinum cyanide. These chemicals are spread on cardboard screens and enclosed in funnel-shaped boxes made to fit the eyes, so as to exclude the light, and are known as fluoroscopes.

The current from a coil or static machine is passed through a thin glass tube known as the Crookes' tube, from which the air has been pumped till the attenuation reaches about the millionth part of an atmosphere. Higher vacuum than this is not used to ad-

vantage, but a lower one can be. The higher vacuum tubes are known as "hard tubes" and the lower vac-



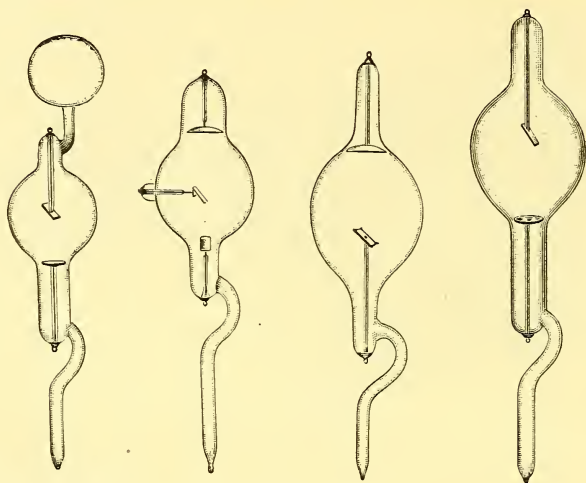
Fluoroscope.

uum tubes as "soft tubes." These tubes were invented by Crookes, long before the discovery of Roentgen. These tubes are of various forms and shapes, made both in America and abroad, but the best and cheapest ones are made in America.

These tubes are held in universal angle clamps, known as tube holders so that they can be placed in any desired position.

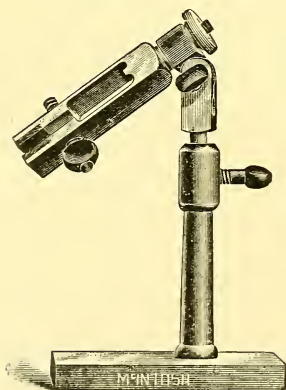
The tubes contain one electrode known as the cathode and one or two electrodes known as the anode. The German tubes have a double anode. The anode is to be attached to the positive pole and the cathode to the negative pole of the coil or machine by means of heavily insulated cords or wire. Spark gaps are placed in the circuit on one or both sides. When only one spark gap is used it is usually placed

on the cathode side. The anode is a flat plate of platinum placed at an angle of 45° to the long axis of



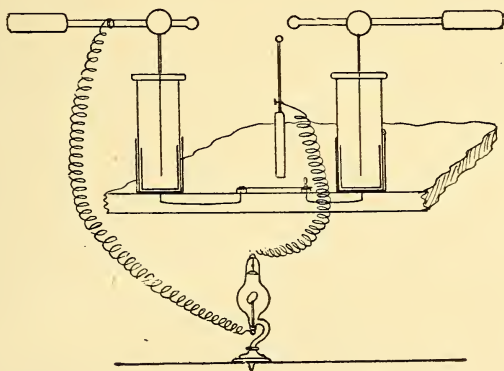
Crookes' Tubes.

the tube. The cathode is a concave disc of aluminum placed so as to focus the cathode rays on the anode. The cathode rays are purple, are visible and are inside the tube, while the X-rays are invisible, colorless and outside the tube. The cathode rays converge or focus and carry with them the particles of air inside the tube, and all are deflected from the anode at right angles, and strike the concave surface of the inside of



Tube Holder.

the glass tube, at a divergent angle from the focal point. This is the most brilliant field of the color to the tube. The color is on the surface of the tube and is a pale greenish-yellow light known as fluorescence, and must be present in order to have the generation of the X-rays. The steadiness and brilliance of this fluorescence depends on the source of generating power, the degree of vacuum and temperature of the tube, and indicates the amount of X-radiance produced.

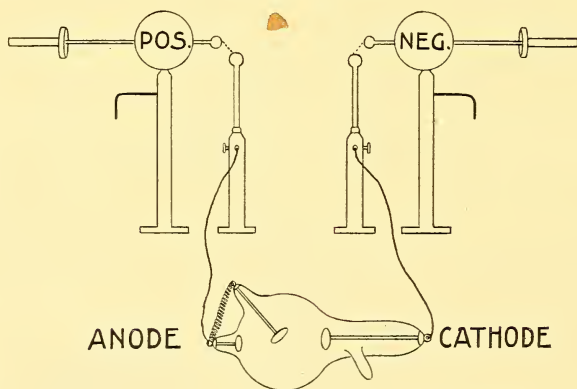


Tube and Connections with Negative Spark-Gap Arranged for Fluoroscopic Work.

Pictures made by the X-rays are properly called radiographs, but are often called shadowgraphs or X-ray pictures, and sometimes very improperly called sciagraphs. They are shadow pictures made by the X-rays on a sensitized plate by something radiating from the tube, therefore the proper term is radiograph. Webster defines sciagraph to be "(Arch) An old term for a vertical section of a building," and is therefore manifestly an improper term.

Almost any good photographic plate can be used for radiographic work, but the one which is probably the easiest to procure and the best to use, is known as the "26 X Lightning Seed, Non-halation plate." The plates should be double wrapped in photographers' black paper and then placed in another wrapper or envelope of yellow or orange paper, and kept in the dark in a cool place, away from the X-ray.

Place the plate beneath or behind the object to be radiographed, with the *film side toward* the tube, with the object intervening. Then when ready excite



Generating Tube and Connections with Double Spark-Gap Arranged for Radiographic Work.

the tube and keep still. The least movement will spoil the outline of the shadow. Have object as close to plate as possible. Radiographs are always a trifle larger than life size, on account of the X-rays diverging, because they are moving at right angles from the convex surface.

The length of exposure depends on the machine,

speed, vacuum, radiance, temperature, spark-gap, leakage, steadiness, glow, fixity, and thickness of object, and distance from tube. The time exposure is usually in the ratio to the distance from tube. Short distance, short exposure, and vice versa. The greater the speed of the machine the better current and radiance.

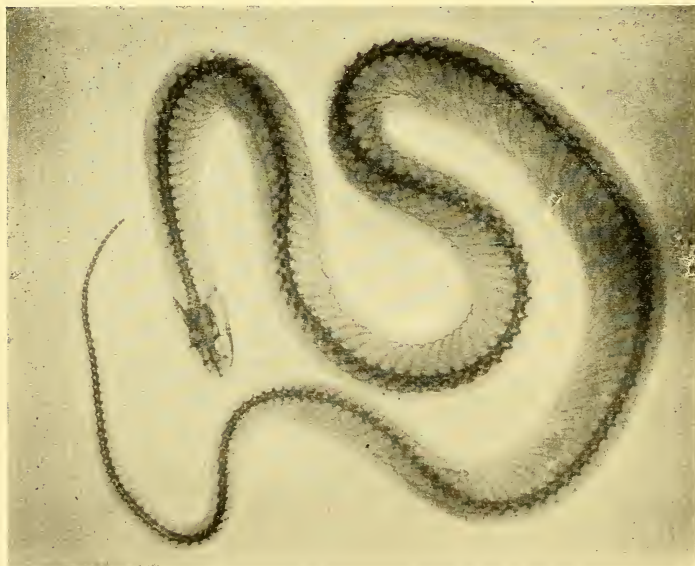
Warming a tube or rubbing with a silk handkerchief often helps it. Heating lowers the vacuum and softens a hard tube. Some tubes work best only when the anode is red hot. For fluoroscopic work the fluoroscope is substituted for the sensitive plate, but the outlines are not as clear as in the negative plate. The platinum screens are better than the calcium for fluoroscopes but are much more expensive.

A calcium tungstate screen placed over the plate, under the object, salt side down, will shorten the time of exposure considerably. Have the most brilliant area of radiation directly opposite or above the part to be radiographed and the tube, object and plate in direct line. Clothing or bandages need not, but metals should be all removed, unless used as land marks. In detecting fractures or dislocations it is best to take radiographs at several angles, and in locating foreign bodies, radiographs of one surface and one side should be made and the missile located by triangulation.

It is easy to distort a normal condition so as to make it appear abnormal and vice versa, so that while X-radiographs are accurate, because showing things exactly as they are in the line of radiation, still the deductions which may be drawn from them may be erroneous, and it is always best to make several exposures or examinations from different sides in order

to be entirely sure. "Figures won't lie," but figurers sometimes will.

Radiographs can be developed and fixed in the same way as photographs, but the developer should be either old or weak, or dilute so as to develop the shadow slowly. A radiograph is merely a shadow, and has neither perspective nor high-lights to bring out, and no focusing is required. A good photographer can bring out an under-timed negative, or tone



Radiograph made with a small four-plate, 16 and 18 inch static machine, with an inch spark, and low vacuum tube, showing what excellent work can be done with a small machine, in fifteen minutes.

down an over-exposed one in developing, and a poor operator may easily ruin both. The same holds true

of radiographs. More plates are under timed than over exposed. After the plate is exposed to the X-rays it is nothing but a negative and is to be treated as such, and prints mounted the same way. It is cheaper and better to let your photographer do your developing, printing and mounting, and also sell you *fresh* plates whenever needed, as that is his specialty.

X-rays can be used to detect diseased conditions of internal organs, and they seem to have a selective action on abnormal tissues. The X-rays are now used to advantage in many forms of skin disease, and especially in skin cancers and lupus, where they produce marvelous cures in hopelessly inoperable cases. Abnormal cells seem to have lower vitality than normal, and succumb to the X-rays soonest. X-rays are also used for the removal of superfluous hairs.

The "Special J" Tube.

This is the simplest and best, and therefore the cheapest American tube, having widely separated terminals sealed into the glass, (instead of caps waxed on the outside), with a stretcher on the anode inside, preventing the platinum plate being warped by heat.



The "Special J" Tube.

HOW TO TELL POLARITY OF BATTERY OR MACHINE.

The positive pole galvanic is acid, and the negative alkaline.

Wet a piece of blue litmus paper; place upon it the cord tips from battery, and turn on current. The paper under positive end will turn red, and the negative tip will turn bluer. Reverse the position and the red spot will again turn blue, showing both acid and alkaline reactions of different poles.

Place cord tips in water and turn on current. Bubbles of hydrogen will come from negative tip, while positive tip will turn black, be covered later with white and nickel will be destroyed.

Place cord tips in saturated solution of iodide of potash; turn on current, and free iodine will be liberated at positive pole and will color the water brown.

Attach cords to steel needles, and insert them into a piece of fresh moist beef; turn on current, and the positive needle will stick fast, while the negative will remain loose, and be surrounded by froth.

To tell polarity of high tension induced (faradic) current, attach a Geisler tube to terminals of coil and start vibrator. Positive end of tube will glow pink, and the negative blue.

Static induced current is tested the same way.

To test polarity of direct static current, start the machine, separate sliding rods an inch or two to get a steady purple stream, one end of which, the positive, will have a white spot. Separate still farther, four or

five inches, and get a steady continuous flow of sparks. The end having a single stream dividing into several about a half inch from ball, like a tree trunk with branches, will be positive, and have a pink color. The other side having a number of streams like tree branches will be negative with bluish color. Separate still farther, six to ten inches, to get the brush or fox-tail discharge like a paint brush on one side and a feather duster on the other. The brush side is negative and bluish; the duster side is positive and reddish. The Leyden jar current on positive side will have a negative polarity, and vice versa.

HOW TO MAKE YOUR STATIC MACHINE WORK IN MOIST ATMOSPHERE.

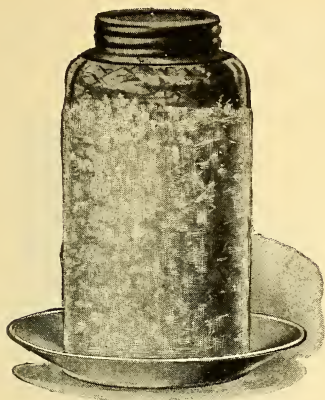
The man with a static machine, usually, and in fact nearly always, has trouble of his own, especially during the hot, moist weather of the months of July and August, and along rivers, lakes and the coast.

Static machines are variable and fickle, but are governed by certain laws which must be obeyed. Moisture and dust are the greatest troubles to contend with. No matter how tight the case may be, dust and moisture will get into it. Some machines are less susceptible to the atmospheric conditions than others, and notwithstanding the claims made by makers, there is no machine that can be depended upon to generate always under every circumstance and condition. We may so alter the circumstances

and modify the conditions that we can be reasonably sure of our machine working, but never be absolutely certain of it.

Some machines have a smaller machine, or charger, inside the case, in order to start the current and charge the larger plates, but even then they sometimes fail to work. The glass and mica plates should be covered with a coating of shellac. Hard rubber plates are left bare. Various methods have been tried to keep the air inside the cases free from moisture, such as lamps, incandescent lights, electric coil heaters, jars of sulphuric acid, common lime, and chloride of calcium, but lamps, lights and coils heat too much, acid gives off destructive fumes, lime dust flies. The most generally used and probably the most satisfactory, when all else is considered, is fused calcium chloride. This is not the ordinary chloride of lime of the stores, which is chlorinated lime, or bleaching powder, which gives off fumes of chlorine gas, which will ruin the metal parts, but the fused chloride of calcium which comes in rough, hard lumps. It should be thoroughly baked, bone dry, in a deep, flat granite or earthen vessel and kept inside the case, all the time. Being very hygroscopic it quickly absorbs all the moisture in the case, and keeps the air within quite dry. As it gets wet it becomes soft and sticky, and should then be removed and again thoroughly dried or baked. Do not allow it to get on the stove or metal part as it will ruin it, but when carefully handled it is safe and reasonably sure. The same calcium can be used over and over indefinitely. Probably the safest, quickest and cheapest way of drying the case is the jar of cracked ice and rock salt. Do not use snow or common salt, or forget the saucer, but

use as follows:—Take a one-quart glass fruit jar with screw top, fill with a mixture of powdered ice and rock salt, screw down the cover and wipe the moisture from the outside of the jar; place the jar in a saucer or bowl



inside the case of static machine, close the door and set the machine in motion, keeping the plates moving until the machine begins to generate at its best. After, say an hour, when the ice is fairly melted, remove the jar and quickly close the end door so as to prevent the outside air from getting into the case. This simple remedy will dry the

air within the case in from five to twenty minutes. Materials for this experiment are accessible to every physician at all seasons of the year, and the application of this remedy is entirely free from the danger of corrosion of the metal parts of the machine and the annoying care and labor of frequent drying and baking of chloride of calcium.

Apply the remedy when next your machine refuses to generate, and it will insure the very best of results in the operation of your machine on any and every day in the year.

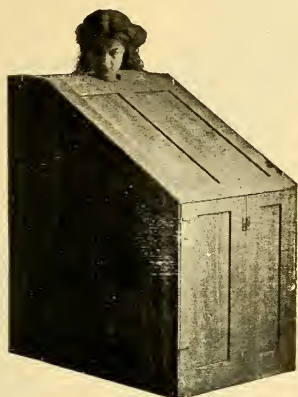
Simply holding a pledget of absorbent cotton against the revolving plate, while in motion, will often cause the machine to generate at once, especially the rubber plate machines.

THE ELECTRO-THERAPEUTIC BATH.

The electro-therapeutic bath, known also as the electro-vapor, or electro-thermal bath, is a combination of the therapy of the modified Russian (steam) or Turkish (hot air) bath, or a medicated vapor or air bath, with electricity. It not only possesses the advantage of the combination, but offers conveniences and facilities for applying the electricity over ordinary methods, worth considering. There are numerous appliances of more or less worth and cost, but the idea in all is to place the patient in some inclosure, filled with plain or medicated hot air, vapor or steam, hot enough to cause profuse perspiration, and while in this condition, to apply electricity generally or locally as desired. The cabinet is usually about four feet in diameter, either round, square or oval, and high enough to cover the shoulders and surround the neck, when the patient is seated within, leaving the head exposed, and protruding through an opening in the rubber cloth or wooden top covering, so that the patient may breathe cool air while the body is subjected to, and bathed in the hot air or vapor, while receiving the electric treatment.

Many delicate or sensitive patients who cannot endure the ordinary Russian or Turkish boiling or roasting process, can take these modified baths, not only with comfort and great benefit, but with pleasure. The combination of hot air and vapor is the best to give, as it thoroughly moistens and softens the skin before the sweat starts, and lessens the resistance of

the skin, thus helping the passing of the electricity. While the pores are filled with salty sweat and the surface covered with hot moisture, the underlying parts are softened, and relaxed, and congested, giving more favorable conditions for general or local faradization or galvanization, than any other that can be



Folding Wooden Portable
Vapor Bath Cabinet
in use.

secured. The electro-thermal treatment clears out the pores, facilitates the exosmosis of dead, effete and poisonous matter, from the system, removes dead cuticle, stimulates capillary circulation, softens and relaxes contracted muscles, ligaments and joints, quickens the heart action, relieves internal stasis and congestion, distributes the blood, raises the body heat, stimulates and invigorates weak subjects, soothes nervous states,

and quiets and rests feverish and restless conditions. The ordinary soap and water or sponge bath may remove what is *on* the surface of the skin, but this bath removes what is *on*, *in* and *under* the skin, as nothing else will, and is the quickest, easiest and best method of elimination, and as a restorative and "jag cure," after a spree it has no equal, often sobering a man, too drunk to stand, in an hour.

Many have a false notion that these baths are weakening, and renders one susceptible to "taking cold," while exactly the reverse is true. The stimulant action of the electricity more than counteracts

thorough rub, and alcohol spray, walk naked in the open air in zero weather and feel warm and well. No one is too weak to take these baths when judiciously given.

Electricity can be applied to a patient while immersed in a water bath, by attaching one electrode to some part of the patient outside the water, and placing the other electrode in the water so as to send the current through the water to the patient to complete the circuit, but this treatment is not as good as the above. Simply placing the patient into water through which a current of electricity is passing is useless, as the current always takes the track of the least resistance, which, in this case is the water, and goes *around* instead of *through* the patient as it should. Another form of electro-thermal bath is known as the electric light bath. In this bath the cabinet is lined with mirrors, and the walls are studded with many incandescent electric lamps, which may be clear or colored, so arranged as to light a few at a time. In this bath the air is dry and is gradually heated by the heat radiating from the lamps, until the desired temperature is secured. This bath is pleasant and beneficial not only on account of the heat but also from the undoubted remedial and often curative effect of the light penetrating the tissues, as we now know that ordinary light goes entirely through the human body, so that a photograph may be made through the body.

The electric light bath combines the effects of thermo, electro, and photo-therapy. Purple, blue and green light is especially helpful in certain conditions, while red and yellow lights have another effect. The electric light, like sunlight, has a wonderful oxidizing effect on the tissues.

ELECTRODES.

The surface of electrodes for ordinary external work should be of carbon, or of metal, nickel plated. For general use these should be covered with sponge or absorbent cotton. The latter is the more cleanly and should be used oftener than it is.

In the therapeutic index where the sponge electrode has been specified, the cotton-covered electrode should be used with equal advantage. The sponge electrode is named as it is in more common use.

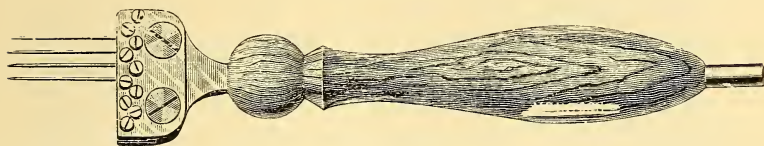
If it is desired to treat a single muscle or nerve a very small electrode must be used to localize the current upon the one point.

Vaginal, uterine, urethral and rectal electrodes should be made of metal (preferably brass) and nickel plated. Block tin and aluminum are used by some. Where it is desired to have an electrode cover considerable surface for using strong currents the clay electrode of Apostoli may be used or a sheet of zinc covered with a heavy moist towel and adjusted to come in contact with the entire surface which it covers.

The wire-brush electrode is used as a counter irritant where there is local paralysis or anaesthesia as it will more powerfully stimulate and irritate the parts than a sponge electrode.

For general faradization or galvanization it is advisable to use a sponge electrode from four to six inches in diameter to cover as large an area as possi-

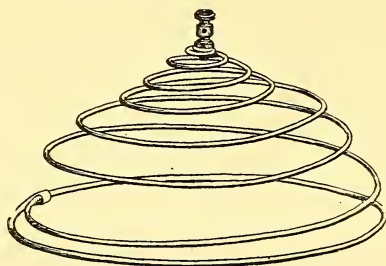
ble. Large electrodes should be used whenever it is desired to use a strong current with the smallest possible pain or burning.



The Bennett Needle Holder.

The above cut shows the first form of the needle holder, invented by DR. H. C. BENNETT, and since it was introduced to the profession it has been improved until now it is the best needle holder on the market. It now has a thumb screw on the handle, and the needle holder is now made in one piece, instead of two as shown in cut. This needle holder was invented as the result of a necessity for it, and it will hold from one to ten needles, and is adapted to the treatment for the removal of small growths of all sizes and shapes, whose bases are an inch or less in diameter. Each needle is held firmly by a separate screw, which allows of one or more needles being removed without disturbing the others. This holder is strong, handsome, well made and inexpensive, and can be used for a variety of purposes. Its uses are well explained in lecture No. 14, of the mail course of the National College of Electro-Therapeutics, on the "Removal of Small Growths and Superfluous Hairs by Electrolysis." This holder is $5\frac{1}{2}$ inches in length, handsomely nickelled, with polished hard-wood handle.

The following cut shows abdominal electrode invented by DR. H. C. BENNETT, and is the simplest, and at the same time the most convenient and inexpensive electrode of the kind yet invented. It is light, cleanly, aseptic and strong. It is adapted to fit any surface or part of the body, and can be applied to the knee, hip, elbow, shoulder, head, back or abdomen, but is intended mainly to fill a long felt want for the light, clean, strong and efficient abdominal



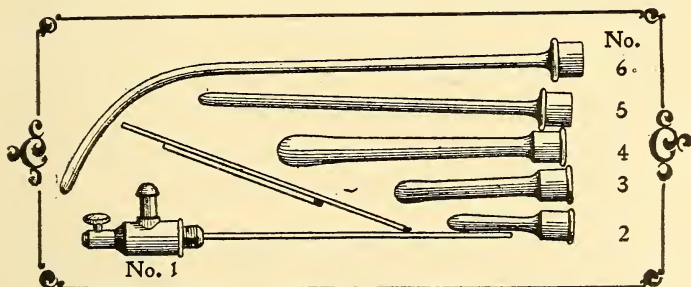
The Bennett Spiral Disc Abdominal Electrode.

electrode. It is applied thus: Wring out of hot water a towel or pad of cotton, square or round, and a little larger than the base of the spring. Place the spring on it, and tuck the edges or corners between the spirals, then place it on the abdomen, with the patient on the back, with a dry towel over it to protect the clothing and retain the heat, then have the patient press it down with her hands, insuring a perfect contact with a good conductor. We have given 200 milliamperes through this electrode without any discomfort. It is made of No. 14 spring steel wire, with a binding post at the apex, handsomely plated, and weighs only 4 ounces. Outside spiral is 8 inches in diameter.

Soluble Electrodes and Their Use With The Positive Pole.

The delicate structure of the mucous membrane linings of the inner openings or cavities of the body is more irritable and sensitive during the course of any inflammation, and the harshness of a metal electrode has a tendency to increase this soreness rather than to allay it. Therefore we have constructed the soluble electrodes (illustrated and described below) to make the application more beneficial, and, in fact, a relief to suffering humanity rather than an irritant.

There is no known case that requires internal treatment but that can be readily reached by this process, such as inflammation, congestion, strangulation, obstructions, ulcers or ulceration, absorption or pathological conditions. Any medicament can be administered by the osmosis process through these electrodes, as a perusal of the list below will show.



These electrodes are made of hard rubber, and protect the mucous membranes from being injured by coming in contact with any metal. Inside is a copper

wire which carries the current, and in connection with the positive galvanic current it produces copper oxy-chloride, which is an astringent, germicide and anti-septic agent, and is invaluable in that respect to the practitioner.

Normal salt solution is used with all these electrodes.

For many years it has been almost impossible, (not to say impractical) to treat internal organs of the body, on account of having to use metal electrodes, which could not adjust themselves to the irregular walls, villi, and folds which are in abundance in all the cavities of the body, and for this reason the soluble process has been adopted. Taking first the treatment of the stomach. We can readily dilate it with a saline solution, and introduce an electrode through the œsophagus and we have a large electrode covering the entire stomach. This will be an invaluable aid in many cases of dyspepsia and other diseases. And if we wish to concentrate the current to any one side it is only necessary to place the outside electrode (size to suit) on a convenient spot to secure the proper direction of the current. Either kind or any current can be administered with these electrodes.

No. 1 is the adapter, and is used to connect both the water and the electric supply to the electrodes which screw on to it.

No. 3 the rectal soluble electrode, can be used to great advantage in constipation and neuritis of the abdomen, intussusception, aperistalsis, appendicitis, and many other disordered conditions of the viscera, as the saline water can be forced, not only to dilate the colon, but also reach the small intestines, so that

they will also be available as electrodes and with this electrode one can accomplish decided results that we have not had the means of doing before.

No. 4 the vaginal soluble electrode. Most of our practitioners know that the orifices of the reproductive organs are a network of sensory nerve cells, or plates, and a tonic to the nerves in these parts is like the gardener sowing his seed in good ground, then hoeing and watering it. Thus we can apply electricity to this organ, without feeling that we may burn the patient, or cause any erosion or unfavorable results.

Nos. 6 and 5 urethral soluble electrodes for both male and female, can be used with great success, especially in cystitis, and other complications of the bladder, as it can be used to wash out that organ, or dilate it with saline water and then you have converted it into a large electrode. These same electrodes can be used (with care) as intra-uterine with great success.

No. 2 the soluble electrode for the ear, is a valuable adjunct to the armamentarium of the electro-therapist, as you can reach the middle ear by many of the saline solutions with ease, when you cannot touch it by any other electrode, and one that is an adept in the use of the currents for disease will readily see the value of these electrodes.

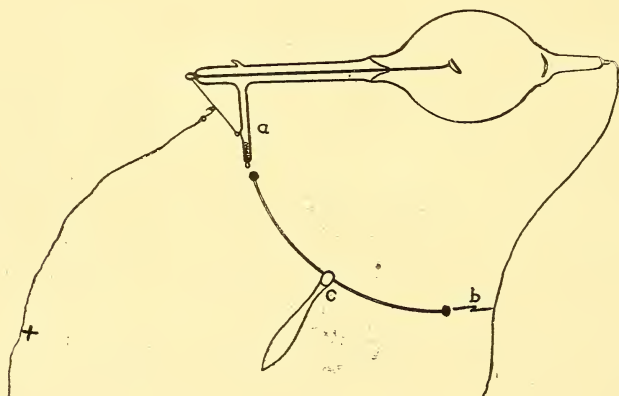


Similar special hydro-electrodes are made for use in the stomach, colon, eye and ear. Much more might be said about these electrodes but space limits.

This cut represents the hydro-eye cup electrode.

X-Ray Tubes and Vacuum Regulators.

There are many so-called adjustable vacuum tubes on the market, most of which are quite complicated, and unsatisfactory, for, as a rule, the simpler the apparatus the better the results obtained, but sometimes the vacuum of a tube will be too high, and it is then advisable to use a tube with a very simple vacuum regulator, like the one here shown.



To get a vacuum suited to your apparatus use a hand regulator, such as shown in the cut (a temporary regulator may be made by twisting a bit of wire on a stick); then cause several sparks to pass into the chemical bulb *a*, place the regulator or short-circuiting rod in contact with the platinum loop at *a* and cause the spark to pass at *b*, as shown in the sketch. This method will prevent puncturing the chemical bulb by a spark, which is liable to occur when the initial vacuum is very high and ordinary methods are followed.

Do not short-circuit the tube and run continuously, as then too much gas will be driven off. A very few sparks, sometimes one or two, should lower the vacuum sufficiently for the time being.

When the tube cools off after use the vacuum will probably go up again, and may be brought down as in the first instance. A long run may also raise it somewhat.

The best X-ray results depend upon a nice adjustment of the vacuum, for which this tube is especially designed. If by chance the vacuum should be lowered too much by using the regulator, prolonged running or rest will raise it again.

We believe that experienced manufacturers of X-ray tubes are in a position to furnish a proper vacuum and one which will not be materially lowered by use.

CONDENSED FACTS FOR THE GENERAL PRACTICIAN WHO USES ELECTRICITY.

P. P. P.=Positive pole for pain.

Electrolysis is chemical, galvanic only.

Cataphoresis is mechanical, galvanic and static.

Catalysis is physiological, galvanic, faradic, static.

Never use a bare metal electrode on the skin.

The faradic has a mechanical and catalytic action.

Mild currents only should be applied to sensitive parts.

The best method of irritation is by rapid change of polarity.

Use iodine preparations under negative pole in cataphoresis.

Use cocaine and alkaloids under positive pole in cataphoresis.

The galvanic is the only current having a chemical action.

Both currents and either pole have a great influence upon nutrition.

Never leave a galvanic or faradic battery turned on or short-circuited.

Do not make long exposures to the X-ray with tube close to patient.

The battery should be in a condition to run continually during treatment.

The electrodes should always be in position before the current is turned on.

Don't try experiments on patients. Try them first on yourself and see how it goes.

Either faradic or galvanic current will stimulate the circulation and improve nutrition.

Mild currents frequently repeated are preferable to strong currents at longer intervals.

The rheostat and milliampere meter should always be used with the galvanic current.

In internal local faradization the primary current acts with greater vigor than the secondary.

A bare metal electrode produces no sensation on the bare skin when using static electricity.

Remember that it is through the process of nutrition that the majority of chronic cases are cured.

Electricity is a faithful and good servant but a fickle and bad master. Learn to be the boss yourself.

The positive pole has a greater contracting power upon unstripped muscular fibers than the negative pole.

Poor connections of conducting cords and elec-

trodes produce frequent shocks by breaking the current.

The static has physiological and catalytic action, also cataphoric, and the induced has a mechanical action.

Shocks should be avoided. Gradually increase and decrease the current, no matter which current is being used.

The galvanic current must be used where it is desired to produce electrolysis or any noticeable chemical effect.

The faradic current acts more markedly upon the muscular system and the galvanic current upon the nervous system.

Do not leave a static machine with the sliding rods touching (short circuit), but always separate them widely.

Conducting cords should be properly insulated. An uninsulated wire upon the flesh produces a painful, stinging sensation.

With the galvanic current the stable application of the positive pole is the most effectual method of diminishing irritability.

Do not approach patient closely when on the insulated stool as sparks will jump from them and cause annoyance or fear.

The galvanic current operates more powerfully by reflex action than the faradic on account of its continually flowing in one direction.

It is frequently advisable to combine or alternate the treatments of general faradization or central galvanization upon the same patient.

Electricity is a tonic of great efficacy and useful

in a wide range of cases, sub-acute or chronic, where a stimulating or tonic effect is desired.

The galvanic has physiological and catalytic, also a cataphoric and chemical action, and the interrupted current is mechanical.

Never use a bare metal electrode on a mucous surface except to check hemorrhage or to get the effect of metallic interstitial cataphoresis.

Frequent interruptions of the current or changes of polarity intensify the effect of the current and are often necessary to relax tense muscles, etc.

The static current is silent, continuous, in same direction, no shock, generated by induction, has low amperage and great voltage, no chemical action.

The static induced is interrupted, but flows in the same direction, but intermittently, is induced, has low amperage, high voltage, no chemical action.

In voluntary muscles, contractions are produced immediately upon applying current, and at the end of the treatment they return to their normal condition.

The primary coil gives more a current of quantity and produces more violent muscular contractions, but lacks the penetrating power of the secondary current.

Galvanization of the sympathetic influences the vasomotor and trophic processes of the brain and spinal cord, the face, eyes, muscles, skin and many parts of the body.

The galvanic current will stimulate the absorbents more powerfully than the faradic current, and is the current to use in removing hypertrophies, morbid growths, effusions, etc.

Don't let female patients take static crown breeze with hats on or with wire or celluloid pins or combs

in hair, as the wire is painful and the celluloid may explode and burn the hair,

It is frequently advisable, in addition to treating the diseased part itself, to apply the treatment to adjacent parts to act indirectly upon the circulation and nutrition of the diseased part.

If your battery or machine don't work, hunt for the trouble till you find it and see if it is not more your own fault than that of the apparatus. "If at first you don't succeed, try, try again."

The positive pole is acid, liberates oxygen, contracts blood vessels, decreases nutrition, coagulates albumen, corrodes metals, causes dry, white, hard scar, relieves pain and irritation.

The negative pole is alkaline, liberates hydrogen, dilates blood vessels, increases nutrition, does not coagulate albumen or corrode metals, causes no scar, but a moist, red, soft condition, increases pain and irritation.

The galvanic current is constant, flowing in the same direction, and is silent, without shock, generated by chemical action, has high amperage or current strength and low voltage or pressure, has chemical action.

The faradic current is alternated and interrupted, flowing in opposite directions, is noisy, gives shock, generated by induction, has high voltage or pressure and low amperage or current strength, has no chemical action.

The electro-thermal bath is a very excellent method of applying general faradization and may be used in any case where this treatment is to be given. The vapor bath of itself is frequently a valuable auxiliary to the electrical treatment.

Good results cannot be secured with a poor battery or improper methods of application. A faradic battery having a small coil of coarse wire produces a crude, harsh current lacking power of penetration and will invariably irritate a nervous patient.

In involuntary muscular fibers, as in the intestines, stomach, œsophagus, contractions are immediately started upon application of the circuit, but the movement when once induced will continue for a considerable time after cessation of the treatment.

The best method of lessening irritability with the faradic current is to begin with a very mild current, gradually increase it to the highest point that does not produce pain, and after holding in position for a few moments gradually reduce the strength of current.

It is not as important in using the faradic current that attention be paid to polarity, yet it is always advisable to use the positive for the active pole when a sedative effect is desired and the negative for the active pole when a stimulating or irritating effect is desired.

Observations with a fluoroscope should be made only in a well darkened room. The operator will soon find that the same apparatus which gives only faint outlines, in broad daylight, will show every detail at night or in a dark room, after his eyes have become accustomed to the darkness.

The secondary coil produces a greater sedative effect and is a current of greater tension and penetrating power, hence more applicable to nervous and deeply seated diseases than the primary current. The finer and longer the wire in the secondary coil, the greater power of penetration and sedation.

In chronic cases it is necessary occasionally to

vary the treatment. Where general faradization has accomplished all that it will, general galvanization may produce still further results. Central or general galvanization may fail in a case where general faradization would produce prompt results and effect a cure.

Electricity sets in motion forces that continue to act for hours and even days after treatment, hence treatment should not be given too frequently. Nervous diseases in particular may be aggravated by too frequent treatments. Ordinary chronic cases require three or four treatments weekly. Acute or sub-acute cases may require daily treatment. Nothing will be gained by treating cases more than once daily.

There is scarcely a chronic disease treated with electricity where we cannot trace at least part of the good results of treatment to the results of nutrition. In the treatment of almost any chronic disease always remember that electricity properly applied will stimulate the circulation, and that the increased flow of blood will bring an increased amount of nutrition; that the contractions of muscular tissue produces the same effect as massage or gentle exercise; that nutrition may be effected through a chemical process; that the process of waste and repair may be promoted, and that the nutrition of the entire system may be improved through reflex action as well as by the direct effect of treatment, securing a constitutional, tonic, stimulating effect.

Brief and plain directions will be given hereafter for treatment of the majority of diseases where electricity may be used to good advantage.

If the foregoing pages of this book have been read and are understood these directions for treating individual forms of disease may be followed with assurance of success.

KEY TO ABBREVIATIONS.

In the outline of the treatment of the various diseases and conditions, the following Abbreviations will be used:

Abd. —Abdomen.	Lab. —Labile or Moving Application.
Alt. —Alternating Current.	Ma. —Milliampere.
Cat. —Cataphoresis.	N. P. —Negative Pole.
Con. —Constant Current.	P. P. —Positive Pole.
C. G. —Central Galvanization.	Prim. —Primary Current (faradic).
B. W. G. —Birmingham Wire Gauge.	S. —Static Current.
E. M. F. —Electro-Motive Force or Voltage.	Sec. —Secondary Current (faradic).
E. O. D. —Every Other Day.	S. Ins. —Static Insulation.
F. —Faradic Current.	S. Ind. —Static Induced.
G. F. —General Faradization.	S. S. —Static Sparks.
G. —Galvanic Current.	Stab. —Stabile or Stationary Application.
G. G. —General Galvanization.	Vag. —Vaginal Application.
Int. —Interrupted Current.	+ Plus or Positive Pole.
Int.-ut. —Intra-uterine.	— Minus or Negative Pole.

Electro-Therapeutics.

Abcess, to abort,

G. con., + at lesion, — at distance, 15–20 ma., 10 min., daily.

Abcess, old, open, to heal, (see Ulcer.)

Abortion, to prevent threatened.

F. sec., (long fine coil, not less than 3000 ft.) G. con., + over abd., or sacrum, — at feet, 40 ma., 20 min.

Abortion, to produce when justifiable.

F. sec., short coarse coil.

G. con., or int., or alt., — int.-ut. + abd., 20 ma., 10 min.

Acne.

G. con., + to point. Cat., with cocaine or bi-chloride sol. on +, or potass. iod. on —, 5 ma., 10 min., daily.

G. f., and c. g.

Adhesions.

G. con., elect. massage with hand or roller, — in vag., or on abd., 10–20 ma., twice a week.

Afterpains, to check post-partum hemorrhage.

F. sec., short coarse coil, — int.-ut., + abd., swelling current.

Alopecia.

G. con., lab., — scalp, 5 ma., 10 min., e. o. d. S. breeze, to head, daily.

Amenorrhoea.

G. con., — sacrum and abd., + feet, e. o. d., or g. con., — int.-ut., or vag., + back or abd., 25 ma., 20 min., twice a week. F. prim., same way, swelling current, g. f. and c. g.

Anaesthesia, local, to produce.

F. sec., long fine coil. G. con., + to part, cat., 10 ma., 10 min., — distant.

Anaesthesia, to remove.

G. con., — lab., 10 ma., 20 min., daily.

Aneurism.

G. puncture, platinum needle or coil of wire, with +, 30 ma., till clot forms. Reverse polarity to loosen needles, — distant.

Angina.

G. con., + over heart, — back of neck, 1-10 ma., 2-5 min. C. g.

Anthrax, (see Carbuncle).**Anus., fissure of.**

G. con., + copper, lab., in fissure, — near, stab., 5 ma., 5 min., e. o. d.

Aphasia.

G. con., + Brocha's center, — behind opp. ear, 3-5 ma., 5 min., daily. S. breeze, 10 min., daily.

Aphonia.

F. prim., or g. con., or int., — throat, externally, or s. ind., elect. massage with hand, + in hands of patient, and along spine, lab. S. ins., 15 min., daily.

Apoplexy.

G. to brain, (see pages 12, 35, 51), — lab., 1–3 ma., 10 min., daily, (after third week only). C. g., and g. f. S. ins., and head breeze, 15 min., daily.

Arthritis, (see Rheumatic Arthritis).

G. con., + to joint, 15 ma., 20 min., daily. G. massage with hand, — feet.

Arthritis Deformans.

If not painful, g. con., cat., potass. iod., on — to joints, 20 ma., 10 min., daily.

Asphyxia.

F. prim., or f. sec. (short coarse coil), — to side neck, + epigastrium, strong current, int. 15–20 times per min., to produce artificial respiration, — stab., + lab.

Asthma.

G. con., + behind ear, — epigastrium, 10 ma., 10 min., daily; g. con., spine, + neck, — sacrum, 15 ma., 20 min., daily; c. g.

Atrophy, Optic, (see Eye Diseases).**Baldness, (see Alopecia).****Birth Marks, (see Naevus).****Bladder, irritable.**

F. sec., (long fine coil), + in bladder, or on sacrum, — abd.; g. con., + abd., or sacrum, — feet, 15 ma., 15 min., daily.

Boils, to abort, (see Abscess).**Boils, open, (see Ulcer).**

Breasts, to develop.

F. sec., (coarse coil), sponge or roller on hand, one to each gland, lab., elect. massage from outside toward nipple; g. con., and int., — to breast with vacuum electrode, + abd., 15 ma., 10 min., daily; g. int., same, 5 ma., 5 min., daily.

Bronchitis.

G. con., to pneumogastric nerve, + in fossa under ear, — top sternum, 5 ma., 10 min., daily.

Bright's Disease.

S. ins., 30 min. daily, + feet bare, or to over head crown, — wet sponge elect., on bare skin over kidneys, surging, 15–30 min., daily; s. breeze, head, 5 min., daily; s. s., spine.

Bunions.

S. s., and roller, short sparks, 10 min., daily.

Burns.

G. con., + 5 ma., 10 min., daily.

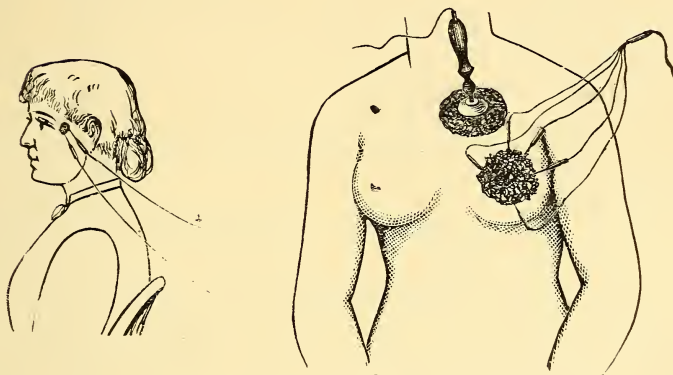
Cancer, (see Carcinoma).**Carbuncle, to abort.**

G. con., + to part, 20 ma., 15 min., daily.

Carbuncle, open, (see Ulcer).**Carcinoma, (see Lupus).**

G. con., general anaesthesia, or local by cat.; — with needles in Bennett needle holder, (see page 91) in base of growth, if small, 10–25 ma., 10 min.; if large, use a number of separate long needles inserted at different angles. In large growths, both poles may be used with platinum + needles. General anaesthesia or Massey gold and zinc mercuric electrodes, (see lecture 30), on

positive, in growth, very strong currents, to 300 ma. Parson's method, g. alt., 300-400 ma., X-rays often used to advantage; soft tube, 5 min., 5 inches away; 10 min., 10 inches away; daily or e. o. d.



Cataract (see Eye Diseases).

Catarrh, Nasal.

G. con., + copper or zinc and mercury electrode, to nose, lab., 10 ma., 5 min., e. o. d.

Catarrh, Uterine, (see Leucorrhoea).

Chanchroid.

G. con., copper or zinc electrode, lab., + to part, 5 ma., 5 min., daily.

Chilblains.

G. con., + lab., to part.; s. breeze and mild sparks, 5 min., daily.

Chloasma, (see Liver Spots).

G. con., — lab., elect., massage, 10 ma., 10 min., daily.

Chorea.

G. con., + forehead and down spine, — feet, 3 ma., 5 min., daily; G. con., spine, 10–15 ma., 10 min., daily; s. breeze, 15 min., daily.

Cicatrix.

G. con., — needle under skin, repeated, 5 ma., 10 min., weekly.

Coldness, of extremities.

F. sec., lab., to parts; g. f.; g. con., — lab., 20 ma., 10 min., daily; s. s., and roller, 15 min., daily.

Comedones.

G. con., electrolysis, — needle inserted, 3 ma., 15–30 seconds.

Conjunctivitis, (see Eye Diseases).**Constipation.**

Either current, + abd., lab., hand, sponge or roller, — back. In chronic cases use — rectal electrode. G. alt., or int., 2–10 ma., 15 min., daily; s. ind., 1–2 inch spark, abd., and back, frequently causes prompt stool; g. f. and c. g.

Corns.

G. con., + or cocaine cat., 5 ma., 10 min., e. o. d.; s. s., or s. + breeze.

Cornea, Opacity, (see Eye Diseases).**Cornea, Ulcer, (see Eye Diseases and Ulcer).****Deafness.**

When due to paralysis or chronic thickening of tympanum; g. con., — hydro-electrode in external ear, + opposite on mastoid; 1–5 ma., 3–5 min., daily. Phono-faradic massage. Mild s. s. to mastoid.

Debility, General, (see Marasmus).

G. f., sec., medium strength, 15 min., c. g., 10 min., alt., e. o. d., s. ins., daily. Electro-vapor baths, (see page 86).

Diabetes.

S. ins., + at feet, — crown, or s. surge alt., + feet, — over kidneys, bifurcated sponge electrodes to bare skin; 25 min., daily; s. s., to entire spine; g. f., and c. g., (see Bright's disease).

Diaphragm, Spasm, (see Hiccough).**Diarrhoea.**

G. f., g. con., abd., to back, lab., roller or hand; + abd., — rectum; 20 ma., 20 min., daily.

Distichiasis, (see Hairs, Superfluous).**Dysmenorrhoea, Virginal.**

G. con., + abd., and sacrum, — feet, 25 ma., 30 min., daily; g. con., carbon or copper elect., (cotton covered), + vag., — feet, abd., or sacrum.

Dysmenorrhoea, Membranous.

G. con., — int.-ut., + abd., 50 ma., 15 min., f. sec., (fine long coil) vag., to abd.

Dysmenorrhoea, Obstructive, (see Stricture and Stenosis).

S. ins., and breeze. s. s. spine; daily.

Dyspepsia.

G. con., pneumogastric, + fossa under ear, — top sternum, 5 ma., 10 min., daily; c. g., and g. f., sec.; (fine coil) 10 min., daily; s. ins., and crown breeze, daily.

Earache.

G. con., + in ear on wet cotton or water electrode, 3-5 ma., 2-4 min.

Eczema, (see Lupus, Carcinoma).

G. con., + to part, c. g., s. s., and s. breeze and ins., daily. Ex-rays, e. o. d.

Electric Hand, (see Massage).**Erythema, (see Hives).****Endometritis, (see Metritis, Leucorrhoea).**

G. con., — int.-ut., + abd., 10-60 ma., 10-30 min., once or twice weekly.

Endometritis, if hemorrhagic, (see Hemorrhage).

G. con., + int.-ut. copper tip. Reverse polarity at finish to loosen electrode.

Endometritis, Virginal, (see Dysmemorrhoea Virginal).**Epididymitis, (see Orchitis).****Epilepsy, (see Hystero-Epilepsy).**

G. con., + forehead, — back neck, 3 ma., 5 min., daily; + lab., spine., — feet, 15 ma., 10 min., daily; c. g., and g. f., sec.; s. crown, 20 min., daily. (See page 51).

Epistaxis.

G. con., + copper elect. in nose, — back neck, 10-15 ma., 5-10 min. Reverse polarity at finish to loosen tip.

Epithelioma.

G. con., — Bennett 1-10 needle holder under base, (see page 91), + any place, 5-20 ma., 10 min.; remove and reinsert needles at right angles to first insertion and repeat; (see Carcinoma and Lupus).

Erosions, Cervical.

G. con., + copper or zinc tip, to os, — abd., 5-20 ma., 10 min., e. o. d.

Eye Diseases, Cataract.

G. con., sponge or eye cup to eye, other pole cheek, slow alt., without shock, 2-5 ma., daily; close with — on eye. Result slow but sure, in soft form.

Eye Diseases, Corneal Opacity.

G. con., — eye cup, + on cheek, 1-2 ma., 2 min., daily.

Eye Diseases, Corneal Ulcer.

G. con., + coppertip to ulcer, — cheek; $\frac{1}{2}$ -1 ma., lab., 1 min., e. o. d., s breeze.

Eye Diseases, Exophthalmic Goitre, (see Goitre).

G. con., + neck, — back, 5-10 ma., 20 min., e. o. d., s. breeze to eye, and crown; 15 min., daily.

Eye Diseases, Glaucoma.

G. con., + cervical sympathetic, whole length of neck, — 7th cervical vertebra, 10-15 ma., e. o. d., also same treatment as for cataract.

Eye Diseases, Foreign Bodies (metal).

Use eye magnet.

Eye Diseases, Iritis.

G. con., + eye cup, — cheek, 2-5 ma., 5-10 min., e. o. d.; s. breeze to eye.

Eye Diseases, Nerve Atrophy.

G. con., + back neck, — forehead and upper cervical ganglia, 5 ma., 5 min., daily.

Eye Diseases, Optic Atrophy.

G. con., + back neck, — forehead or use water eye cup, alt., every min., close with — on eye, 2-5 ma., 10 min., daily; s. breeze.

Eye Diseases, Pterygium.

G. con., platinum needle, +, 1-2 ma., or eye cup, 2-5 ma., 10 min., e. o. d., — back neck.

Eye Diseases, Retino-Choroiditis, (see Iritis).

Eye Diseases, Strabismus.

G. int., or f. prim., + eye cup, — temple toward weaker muscles, 1-3 ma., 5-10 min., e. o. d.; s. breeze.

Eye Diseases, Trachoma.

G. con., + copper tip, lab., to granulations, — in hand, cocaine, 3 ma., 2 min.; or — needle in each granule, + hand, 2 ma., weekly.

Eye Diseases, Trichiasis and Distichiasis, (see Hairs, Superfluous).

Eustachian Tube, (see Stricture and Stenosis).

Eye Diseases, Wild Hairs, (see Hairs, Superfluous).

Facial Paralysis, (see Paralysis).

Facial Spasm.

G. con., + above or in front of ear, — back neck, 5 ma., 5 min.

Faradization, General, (see page 50).

F. sec., — at coccyx or feet, stab., + lab., all over body, (see electro-vapor bath, page 86).

Fever, Convalescence.

S. ins., and crown breeze, 20 min., daily; s. surge, g. f., and c. g., e. o. d.

Fever, Hay Fever.

G. con., + copper tip to nose, lab., — hand or cheek, stab., 5-10 ma., 10 min., daily; s. ins., and ozone inhalations, 20 min., daily.

Fibroids, Uterine.

G. con., + abd. or sacrum, Bennett disc, (see page 92), — int.-ut., 20–200 ma., 10–30 min., weekly. If hemorrhagic, + int.-ut., copper or zinc tip, — abd.; reverse polarity at close to loosen tip.

Fissure, Anal, (see Anus, Fissure of).

G. con., + copper or zinc tip, lab., — abd., or back, 5 ma., 5 min., weekly.

Fissure, Nipples.

Same treatment as above.

Fistula.

G. con., same as Fissure or Ulcer.

Freckles.

G. con., — needle under spot, same as in removal of hairs.

Furuncle.

Treated same as boils.

Frost-bite, (see Chilblains).**Glands, Enlarged, (see Tuberculous Glands).**

G. con., — over gland with or without cat., of iodide potash; + opposite; g. alt., same way; 10–20 ma., 20 min., e. o. d.; s. s. and breeze.

Galactorrhoea, to increase.

F. coarse wire, lab., to breasts, elect. massage; g. con., — wet sponge pad to breasts, + spine, 10–15 ma., 30 min., daily; vacuum elect., with either current; — breasts, + back pad.

Galactorrhoea, to diminish.

G. con., + with concave clay or cotton, or Bennett disc over towel, (see page 92) or cup electrode, over breasts; — back, 20 ma., 10 min., daily.

Gastralgia.

G. con., to pneumogastric, + in fossa below ear, — top sternum, 5–10 ma., 15 min., gradually increase and decrease, (swelling current); G. con., + over stomach, — seat or feet, 20 ma., 5 min.; F. (fine coil rapid vibrator) over stomach, to back. S. ins., and crown breeze.

Gestation, Ectopic.

G. int., — in rectum or vag., nearest to sac, + Bennett abd. disc, (see page 92) to abd., slow int., 20–80 ma. F. fine wire, slow vibrator, after growth is checked treat same as fibroid tumors, (which see).

Gleet.

G. con., bare urethral or stricture tip, — same as for strictures, or G. con., + copper tip, lab., urethra, — thigh pad, 6–10 ma., 5 min., e. o. d. If any inflammation use soluble hydro-elect., set, with copper rod and warm water; + in urethra, — thigh. (See page 93).

Goitre.

G. con., cat., — saturated sol. of potash iodide; + opposite, 15–30 ma., 20 min., e. o. d., treat same as enlarged glands. G. con., puncture, may be used but is dangerous and not advised.

Goitre, Exophthalmic.

G. con., — hydro-elect., eye cup, + back neck, 2–3 ma., 5 min., e. o. d.; s. breeze, to eye and neck, daily, (see Eye Diseases).

Gonorrhoea, (see Gleet).

Gout.

G. con., + sponge to joint for pain, — in hands, 5–10 ma., 20 min., daily. G. con., cat., potash or lithia iodide, sat. sol., — to lesion, + near by, 10–20 ma., 20 min., e. o. d.; s. s. to joints, s. ins., and breeze; 20 min., daily.

Haematocele, Pelvic.

G. con., + carbon elect. in vag., near lesion, — Bennett abd., disc (see page 92) abd., 25–100 ma., 20–5 min., e. o. d.

Hemorrhage, Cerebral.

G. con., + over lesion, — opposite, 3–6 ma., 5 min., daily, after third week. (See Apoplexy).

Hemorrhage, Post-Partum.

F. (coarse coil), 1 pole int.-ut., other Bennett abd. disc (see page 92), abd., swelling currents.

Hemorrhage, Uterine.

G. con., copper tip, + int.-ut., — abd., (Bennett disc), 20–40 ma., 20 min., e. o. d.; reverse poles to loosen tip at close. (See Menorrhagia, Metrorrhagia and Obstetrics).

Hemorrhoids.

G. con., + copper elect., preferably covered with wet leather, to pile, — abd., 15 ma., 10 min., e. o. d. Bare copper or zinc tip. G. con., + may be applied per speculum, lab., — abd., when bleeding. Hard external piles best treated by steel needles held in Bennett holder, (see page 91). G. con., — to needles in piles, + on back or abd., 10–20 ma., 10–20 min., one treatment usually sufficient.

Hair, Superfluous.

G. con., — fine steel needle, blunt, + in hand pad; a few cells only needed, 5–8 ma., $\frac{1}{2}$ –2 min., — needle in follicle, patient completes circuit by placing hand on wet pad. Needle inserted first with slight rotary motion. Round blunt needle. A little hydrogen froth appears, and hairs lift out easily with forceps, a self-retaining spring eyeglass is needed.

Hay Fever, (see Fever).**Headache.**

G. con., + over pain, — opposite, sponge pads, 2–4 ma., 5 min.

Headache, Anaemic.

Pole just reverse to above. Operator's hand may be used as electrode, skin wet, passing current through his body. S. breeze, point or crown, 15–20 min., daily.

Headache, Hyperaemic.

G. con., + forehead, — nape neck, (see page 51).

Herpes Zoster.

G. con., — to lesion, + opposite, 10 ma., 20 min., daily; or potash iodide cat., as above. S. s. or s. breeze to lesion, daily.

Hiccough.

G. con., pneumogastric, + in fossa under ear, — top sternum, 5 ma., 5 min., hourly till checked. C. g.

Hives, (see Hyperaesthesia, Skin).

G. con., + plain wet or cocaine cat., to lesion lab., — distant; 5–10 ma., 10–20 min., or till relieved.

S. ins., and s. point + breeze to lesion, — feet 20 min., or till relieved; daily.

Hydrocele.

G. con., — to fibroid spear, driven into fluid sac, + thigh, 5–30 ma., 5–10 min., or fluid can be tapped and sac injected with solution iodide of potash (1 to 20 %) and then treated as above.

Hyperaesthesia, Skin.

Hydro-elect bath. G. con., + electrode in water surrounding part, other electrode — attached to any part of body out of water; 15 ma., 15 min., daily. (See page 89).

Hyperaesthesia of Stomach.

G. con., + over stomach, — back, 10 ma., 10 min., daily.; f. same way, (long coil), hydro-elect. method, stomach electrode swallowed.

Hypertrophy, Turbinate.

G. con., + platinum or gold needles; puncture to lesion, both poles close together, 20 ma., 5 min., weekly. G. con., — to steel needle, puncture lesion, + in hand, cocaine anaesthesia, local, 10 ma., 5 min., weekly.

Hypochondria.

G. g., and c. g., and g. f., g. con., + lab., spine, — feet, 15 ma., 15 min., daily. S. ins., s. s., spine, breeze and crown. Roller, spine; 30 min., daily.

Hysteria.

Same as Hypochondria, but particularly examine for and properly treat any uterine derangement.

Hystero-Epilepsy, (see Epilepsy).

Same as Hysteria, g. con., + on long spinal pad, 2x24 inches, — abd., or feet, 20–30 ma., 20 min., daily; or same with static induced. Carefully examine and treat uterine troubles.

Incontinence, of Urine, (see Urine, Incontinence).

G. con., + spine, — feet or perinaeum, 10–15 ma., 10 min., daily. F. in urethra or bladder, other pad on pubes, or f. to pubes or perinaeum, and other pad on sacrum. S. s. to sacrum.

Inertia, Uterine.

F. (coarse coil) or prim., bipolar int.-ut., or one pole int.-ut., other vag., or abd., 5–10 min., swelling current, every hour or two. (See Hemorrhage, Post-partum).

Infantile Paralysis, (see Paralysis).**Inflammation.**

G. con., + to lesion, — to opposite, mild currents, short treatments, often.

Insanity.

C. g., mild, g. f., if maniacal, treat same as Headache, Hyperaemic; if melancholic, treat same as Headache, Anaemic; s. ins., and breeze; s. s. to spine, (see page 51), 20 to 30 min., daily.

Insomnia.

G. con., + forehead, — nape neck, 2–3 ma., 10 min., or + nape neck, — epigastrium, (c. g.), 10 ma., 15 min., or + 7th cervical vertebra, — coccyx or ft., 15 ma., 20 min., s. ins., and crown breeze, 20 min., s. surging, sponge pad, wet, to spine, or back of neck, and other pole to crown, (see page 51), daily.

Insulation, for needles.

Coat all but points with shellac. Dry till hard.

Intercostal Neuralgia, (see Neuralgia).

Iritis, (see Eye Diseases).

Jaundice.

G. f., g. int., lab., massage roller or sponge pad over liver, 20 ma., 30 min., e. o. d.

Joints, Enlarged.

G. con., — over lesion, + opposite; potash iodide cat., 20 ma., 20 min., daily, s. s., to joints, daily.

Lactation, Excessive (see Galactorrhoea).

Lateral Sclerosis.

Hydro-elect. baths daily, (see Hyperaesthesia of skin. G. g., spinal, g. con., — spine, + feet, 20 ma., 20 min., e. o. d.

Lead Paralysis, (see Paralysis).

Leucorrhoea, Vaginal.

G. con., + copper tip, vag., — abd., Bennett disc, (see page 92), 20 ma., 20 min., e. o. d.; or g. con., — nickel tip, bare, lab., vag., + abd., as above.

Leucorrhoea, Uterine.

G. con., bare copper tip, int.-ut., — abd., as above, 20 ma., 20 min.; reverse poles to loosen tip, or aluminum or nickel tip, — int.-ut., + abd., 20 ma., 20 min., e. o. d. Hydro-elect. douche, daily. (See page 93).

Liver, Cirrhosis.

G. f., g. int., + lab., over liver, — back, 20 ma., 10 min., daily, slow int.

Liver Spots, (see Chloasma).

G. con., — sponge to spots, lab., + in hand, 5 ma., 10 min., daily.

Locomotor Ataxia.

G. con., — to spine, long pad (2x24 inches), + feet, 10-20 ma., 20 min., e. o. d. Hydro-elect. bath, (see page 89). See Lateral Sclerosis, and Hyperaesthesia of skin. S. s., spine, s. breeze and roller. Few if any cases will be cured, but many will be helped.

Lupus.

G. con., + bare copper tip to lesion, lab., — near, stab., 10 ma., till green color is shown. Dipping tip into brine hastens action, due to the formation of the oxy-chloride of copper. Cover surrounding parts with cotton, 1 in. thick, over this lay a sheet of lead, with window size of growth, above and opposite lesion. Expose to X-ray, (see page 72) above opening for from 3-10 min., 3-10 inches distant, every day until a gray exudate appears, then expose less often, according to reaction produced, for from 1-3 mos., or till cured.

Mania, (see Insanity).**Marasmus, (see Debility, General).**

G. g., c. g., g. f., s. ins., s. s., spine, s. roller, med. currents, 20 min., daily.

Massage, Electr.c.

Bipolar roller may be used locally, or one pole attached to body of patient, the other to roller or sponge electrode, and applied by operator, or operator may hold other pole in his left hand and

apply his right hand as an electrode with massage called "The Electric Hand."

Melancholia, (see Hypochondria).

G. con., — nape neck, + spine, and feet, 10 ma., 20 min., e. o. d., (see Insanity and Headache.) G. f., s. breeze, and roller, s. s., spine, 20 min., daily. (See page 51).

Meningitis.

G. con., + parietal, — under ear, 3 ma., 5 min., daily; or — sternum, + back neck, lab., 5 ma., 10 min., daily, s. ins., and breeze, 15 min., daily.

Menopause, Disorders.

G. con., — int.-ut., + abd., 20-40 ma., 20 min., weekly; f. same way, s. ins., and breeze, s. s., spine, s. surge, to sacrum, 20 min., daily.

Menorrhagia.

G. con., + copper, tin, or zinc tip, bare, int.-ut., — abd., 20-100 ma., 5-20 min., e. o. d., reverse poles to loosen tip, (see Hemorrhage, post-partum and uterine).

Metrorrhagia, (see Menorrhagia).

Metritis.

G. con., + bare copper or zinc tip, int.-ut., — abd. (Bennett disc, see page 92), 20-100 ma., 10-20 min., e. o. d., or weekly, (see Leucorrhoea).

Metritis, Peri and Para, acute.

F., long fine coil, bipolar, int.-ut., and vag., 15 min., daily.

Metritis, Sub-acute.

G. con., + as for Metritis above.

Miscarriage, (see Abortion).

Moles.

G. con., steel needle, Bennett holder, (see page 91), — under base of mole, + in hand, (see Carcinoma and Epithelioma).

Moles, Hairy.

Remove hairs first, (see Hairs, Superfluous and Naevus).

Muscular Atrophy.

F. lab., massage, elect. hand, or roller; g. con., spine, g. g., g. f.

Muscular, Contractions and Cicatrices.

G. con., — over lesion, + opposite, 10–15 ma., 15 min., daily, elect. massage.

Myalgia, (see Rheumatism, Muscular).

Myelitis.

G. con., + nape neck, — lumbar spine, 10 ma., 20 min., daily; g. alt., spine to sternum, s. s., spine.

Naevus, Vascular.

G. con., + small wet cotton or sponge pad, to mark, after applying chromethylate sodium, — near, 5–10 ma., 5–10 min., top peels off in 1–2 weeks, repeat till removed. G. con., — needles, Bennett holder (see page 91), from 1–10 needles introduced beneath and parallel to surface, + near. Remove needles and reinsert at right angles to first direction, beneath and parallel to surface and repeat treatment, 5–10 ma., 5–10 min., one treatment usually sufficient, but may have to be repeated. Can use cocaine anaesthesia, locally by + g. cat., to relieve pain, or can apply the

chromethylate sodium afterward, surface blackens, dries and falls off in 1-10 days, leaving healthy granulating surface, which treat with witch hazel and dioxygen. Keep protected from air with ointment yellow oxide or mercury. Never allow scab to be picked off. Let it fall off. White scar results which gradually resumes natural color. If area of mark be large, best treat small part at a time.

Naevus, Hairy.

Usually fine and brown. Remove hairs singly, (see Hairs, Superfluous), and if mark is not gone by time hairs are all out, then treat as above, (see Mole). X-ray can be used also, (see Lupus).

Nasal Spurs.

G. con., + and — needles, platinum, close together, puncture, 5-10 ma., 3-5 min., e. o. d., cocaine spray first.

Nasal Stricture.

G. con., — weekly. Treat same as urethral or other stricture, which see.

Nasal, Hypertrophy.

G., Same as above, or linear galvano-cautery.

Nettle-rash, (see Urticaria).

Neuralgia.

G. con., + to seat of pain, lab., and stab., — distant. On head, 3-5 ma., 5 min., daily; on body, 10-20 ma., 10-20 min., daily. F., very long fine coil, sec., same as above. S. crown or single point breeze, 10-15 min., daily, s. ins.; g. con., + cat., cocaine, chloroform, or aconite.

Neurasthenia, General.

G. con., + to head, neck and spine, — at coccyx or feet, c. g., g. f., s. crown breeze and s. ins., 20 min., daily, s. roller, to spine, s. surge, spine and neck.

Neurasthenia, Sexual.

G. con., — to steel sound in urethra, + sacrum, 5-8 ma., 10 min., e. o. d., + spine, lab., — feet, 10-20 ma., 20 min., daily; s. surge, + sponge on perinaeum or nape neck, — to over head crown, begin with short spark, and slowly lengthen, 20 min., daily. (See pages 24-27).

Obstetrics, Uterine Inertia.

F., int.-ut., and abd., short coarse coil, sec., swelling currents, until contraction occurs. Repeat hourly if necessary. Bennett abd., (see page 92) to other pole.

Obstetrics, Post-partum Hemorrhage.

Same as above. (Also see Hemorrhage).

Obstetrics, Retained Placenta or Foetus.

Same as above.

Oesophagus, Stricture, (see Stricture).**Optic Nerve, Atrophy, (see Eye Diseases).****Orchitis.**

G. con., + in cup of water in which scrotum is immersed, — sacrum or feet, 10 ma., 10-15 min., daily.

Ovaralgia.

G. con., + over ovary, or in vag., — back, stab., 10-20 ma., 15-30 min., daily; f., long fine sec., same way.

Ovaritis, (see Ovaralgia).

Paraplegia, (see Paralysis, Ataxia, Sclerosis).

Pain.

P. P. P., always remember, g. con., positive (+) pole for pain. F., long fine sec., g., cat., + cocaine, s. breeze, localized or crown.

Paralysis.

G. con., + stab., over sternum, — lab., over affected areas, moderate currents up to tolerance. Repeated, p. r. n. but NEVER treat until all inflammation has subsided.

Paralysis, Agitans.

G. con., + forehead, — neck, 3-5 ma., 5 min., daily; + sternum, stab., — spine, lab., 10-15 ma., 10 min., daily; s. breeze, crown; s. ins., s. s., spine, 15 min., daily.

Paralysis, Aphasia.

G. con., — stab., over left 3rd frontal convolution, (Brocha's Center), + on mastoid process, on opposite side, 3-5 ma., 5 min., daily; s. crown breeze and point, 20 min., daily. (See Aphasia.)

Paralysis, Diphtheritic.

Electric hand, with f., prim., or g. int., or s. ind., with massage, using hand as electrode, skin and hand wet, apply to the muscles of the throat, or apply with two small sponge pads, lab., on opposite side of throat, 5-10 ma., 5-10 min., daily.

Paralysis, Facial.

G. con., — over nerve in front of ear, lab., + back neck, stab., 3-5 ma., 10 min., daily; f., elect. massage, to affected muscles, 5 min., daily; s. point

breeze to cheek, s. surge, 1 pole to cheek, other over head crown, 5 min., daily.

Paralysis, Hemiplegia.

G. con., + back neck, stab., — on temple and under ear., lab., 3-5 ma., 5 min., daily.; g. int., or f., coarse coil, lab., to affected muscles; elect. hand massage; s. s., and s. roller, to spine and muscles, 15 min., daily.

Paralysis, Hysterical.

G. g., g. f., and c. g., s. ind., s. s., and s. roller, over spine and muscles; s. crown breeze, and s. ins., 30 min., daily.

Paralysis, Infantile.

G. con., lab.; — over affected areas, + opposite, 5-10 ma., 10 min., daily; g. g., c. g.; f., coarse coil, sec., elect. hand massage.

Paralysis, Intestinal.

G. int., lab., + on abd., roller or sponge pad, — back or rectum, 10 ma., 15 min., daily; move abd. pad around, along and over course of colon, downward, slow int., f., prim., or coarse coil, sec., same way; s. ind., same way; hydro-elect. rectal injection, (see page 93) knee chest posture, — in rectum, long colon tube electrode, + abd., or back, fill bowel full salt water.

Paralysis, Lead.

G. con., baths, (see Hyperaesthesia.)

Paralysis, Ocular Muscles.

G. con., — hydro-elect. cup, or wet sponge over eye, + back neck, 3-5 ma., 5 min., daily; f., fine coil, mild, same way, s. ind., same way, local s.

point breeze to eye; short s. s., temples and neck, daily.

Paralysis, Oesophagus.

G. int., — to throat external, lab., + back neck, stab., 5-10 ma., 10 min., daily; f., prim., same; elect. hand massage, same.

Paralysis, Paraplegia, (see Paraplegia, Ataxia, Sclerosis).

Paralysis, Peripheral, Facial, (see Facial Paralysis).

Pelvic Diseases, Inflammations, Exudates, and Adhesions.

G. con., — in vag., + Bennett abd., disc, (see page 92), 20-50 ma., 10 min., e. o. d., g. con., + abd., — back, same way.

Pelvic, Peritonitis, Chronic.

Same as above.

Piles, (see Hemorrhoids).

Podalgia.

G. con., + heel, — hands, 10-20 ma., 20 min., daily; s. surge + foot, — crown, 20 min., daily.

Polio-Myelitis, (see Myelitis).

Post-partum Hemorrhage, (see Obstetrics, Menorrhagia, Hemorrhage).

Pregnancy, Extra-Uterine, (see Gestation, Ectopic).

Pregnancy, Vomiting.

G. con., + in fossa under ear, — to top sternum, or over stomach, 5-8 ma., 10-20 min.; or + over stomach, — sacrum, 10 ma., 20 min.

Prostate Gland, Hypertrophy.

G. con., with flexible wire elect., covered with cotton, sat. with sol., of potass. iodide, inside a

perforated hard or soft rubber catheter, in urethra, + on back, 5-8 ma., 5-8 min., e. o. d., to weekly. G. con., + carbon tip in rectum above gland, — sponge pad, perinaeum, 5-15 ma., 10-20 min. e. o. d.

Prostate Gland, Granular.

Same as above only with a copper wire inside catheter, wet with salt solution, hydro-elect. soluble set. (See page 93).

Prolapsus, Uteri.

G. int., — int.-ut., + abd., or back, slow int., 10-20 ma., 20 min., twice a week; f., prim., same; s. ind., same.

Proud Flesh, (see Ulcer and Lupus).

Pruritus.

G. con., + to lesion, lab., — opposite, stab., 5-10 ma., 10 min., daily; f., long fine coil, same, s. breeze, local point, 10 min., daily.

Pruritus, Scrotal, (see Orchitis).

Rectum, Stricture, (see Stricture).

Rectum, Ulcer, (see Ulcer).

Rectum, Anal Fissure, (see Anus, Fissure).

Rectum, Paralysis, (see Paralysis, Intestinal).

Rectum, Hemorrhoids, (see Hemorrhoids).

Rectum, Prolapsus, (see Prolapsus Uteri).

Rheumatism, Articular.

G. con., cat., lithia or soda salts, (see pages 31, 33); g. con., + lab., — opposite, lab., 10-20 ma., 10-20 min., daily. If very painful, — distant; elect. hand massage; s. local point breeze, s. s., 5 min., daily. (See Gout).

Rheumatism, Muscular.

G. con., + elect. hand massage, or g. con., + lab., to muscles, — distant, 10–20 ma., 20 min., daily; s. s., s. roller, to muscles, s. ins., 10 min., daily.

Rheumatoid Arthritis, with Deposits and Anchylosis.

G. con., — lab., cat., sat., sol. iodide potash, to joints (see pages 31, 33,) + opposite, 15–20 ma., 20 min., daily; s. s., elect. hand massage, (see Gout and Arthritis Deformans).

Ringworm.

G. con., copper or zinc tip, + to lesion, wet with salt water, — distant, on head, 3–4 ma., on body, 10–20 ma., 2–5 min., e. o. d.

Salpingitis.

G. con., + in vag., — sacrum, 10–20 ma., 20 min., e. o. d., (see Ovaritis, and Pelvic diseases).

Sarcoma.

G. con., — needles under base, + near by, 10–20 ma., 10–20 min., weekly, (see Carcinoma, Lupus, Moles, Epithelioma).

Scars, (see Cicatrix and Naevus).**Scars, (see Cicatrix, Muscular Contractions).****Sciatica.**

G. con., + lab., along nerve, — stab., feet, 10–30 ma., 10–15 min., daily; s. s., to nerve, and spine, s. breeze, s. surge and s. ins., 15 min., daily.

Scirrhus, (see Carcinoma).**Sclerosis, (see Lateral Sclerosis, Paralysis).****Shingles, (see Herpes Zoster).****Singultus, (see Hiccough and Spasm Diaphragm).**

Sleeplessness, (see Insomnia).

Spasm, Facial.

G. con., + above or in front of ear, — back neck, 5 ma., 5 min., daily; s. breeze, local point, or crown, s. ins., 15 min., daily.

Spasm Diaphragm, Hiccough.

G. con., + fossa below ear, — top sternum, or over stomach, 5 ma., 5 min., or + on stomach, — between shoulders, or back neck, 10 ma., 10 min., daily; f., long fine coil lab., over stomach, to back, 5 min., every 3 or 4 hours,

Spasm, Sterno-Cleido-Mastoid, (see Torticollis).

Spasm, Bladder.

G. con., + over pubes, — sacrum, 10–20 ma., 10–20 min., daily.

Seminal Emissions, (see Spermatorrhoea).

Spermatorrhoea.

G. con., + in rectum, — abd., 5–10 ma., 10 min., e. o. d.; g. con.; + perinaeum, — feet, or g. con., + spine, — feet, 10–15 ma., 10 min., daily, (see Hemorrhoids, Prostate, Orchitis).

Spinal Meningitis.

G. con., + back neck, base brain, stab., — lab., down spine, 5–10 ma., 10 min., daily; s. ins. and breeze, 15 min., daily.

Spleen, enlarged.

G. con., — over spleen, lab., deep massage or roller, + sacrum, 15 ma., 10 min., daily; f., fine coil, sec., or s. ind., same way.

Stenosis, Uterine.

G. con., — tapering tip, int.-ut., + abd., 20–40 ma.,

20 min., twice a week, using larger tips successively. (see Stricture, Urethral, and Dysmenorrhoea.

Sterility, Infantile Uterus.

G. con., — vag., or int.-ut., + abd., 20 ma., 20 min., e. o. d.; g. int.; f., coarse coil, same. (See Leucorrhoea, Metritis, Dysmenorrhoea, Stenosis.)

Stricture, Urethral.

Stricture, Eustachian.

Stricture, Lachrymal.

Stricture, Nasal, (see Nasal).

Stricture, Oesophageal.

Stricture, Rectal.

Stricture, Urethral.

Stricture, Uterine, (see Stenosis).

Stricture, Vaginal.

The treatment of strictures is practically the same in any canal, the only difference being in the size of the electrode tip and the strength of current and duration of treatment, governed in each case by the location, extent, character and patient. The plan is to find out the caliber of the stricture, then use a tip a size larger so as to put the stricture on a tension, thus insuring perfect contact for electrolysis, by which process the stricture is removed. (See page 29). Use only the galvanic current; attached to the bare metal tip on an insulated staff within the canal. This is attached to the negative pole only. Introduce the electrode till it strikes the stricture, + pole on some indifferent part. Turn on current slowly till it is distinctly but not painfully felt by patient; 2-10

ma. Use gentle pressure and wait till the tip passes through the band, which it will do in from 2 to 20 min; remove same way, till band is again passed, then turn off current, and remove electrode. Repeat in 3 to 10 days, and continue, each time using a larger tip, till the stricture is removed.

Subinvolution, Uterine.

F. sec., coarse coil, slow int., bipolar elect., int.-ut., or one pole abd., other in rectum or on abd., 15-20 min., daily; swelling currents; s. ind., same way. G. — int.-ut., + Bennett abd. spring, (see page 92) abd., 20-40 ma., 15-30 min., e. o. d.

Superfluous Hairs, (see Hairs, Superfluous).

Syphillis, Chancre, (see Chancroid, Warts).

Swelling Currents.

Applying currents, gradually increased and decreased in strength, without interruption, or shock slowly; repeating rise and fall every minute or two. (See Glossary).

Toothache, Neuralgic.

S. breeze, point + to pain — crown 10-15 min.; s. ins., 20 min., daily; g. con., + sponge pad over nerve, — back neck, lab., or stab., 2-5 ma., 5-10 min.; g. + platinum wire wrapped with cotton dipped in strong cocaine sol., to cavity, — in hand, 1-3 ma., 5-10 min.

Tonsils, Enlarged.

G. con., + platinum spear in tonsil, — in hand, moving needles to prevent them sticking, 10-15 ma., 5 min., e. o. d.; g. con., — cup shaped electrode to surface of tonsil, + hand, 5-10 ma., 5

min., daily; g. con., — steel needle, in gland, + hand, 5 ma, 3 min., daily; galvano cautery point in gland.

Tonsils, Folliculitis.

G. con., — needle in follicles, or g. con., + copper wire elect., in follicles lab., — hand, 2-6 ma., 2-3 min., daily.

Torticollis.

F. sec., coarse coil, slow int., 10 min., lab., to muscles of opposite side, daily; g. con., + pad to drawn muscles, lab., — hand, 10-20 ma., 15-20 min., daily; s. s., to weaker muscles, s. ins., elect. hand massage; g. con., daily.

Trachoma, (see Eye Diseases).

Tumors, Benign.

G. con., — over growth, + opposite, 10-30 ma., 10-20 min., e. o. d.; g. con., — Bennett needle holder, (see page 91) from 1-10 needles according to size of base. Insert needles beneath base, + in hands, (see Warts, Moles, etc.) Remove and reinsert as before, 5-20 ma., 10-20 min.

Tuberculosis.

G. g., g. f., c. g., electro-vapor bath, (see page 86,) (see Marasmus, Debility, Fever Convalescence). S. ins., s. point and crown breeze. Ozone inhalations; electric light concentrated over lesion, especially violet light; s. cat. as follows: cover chest or skin over lesion with cotton pad wet with solution formaldehyde, creosote, ligno-sulfite or other volatile substance, patient on ins., platform connected with —; s. + point or brush breeze directed over medicated pad, 30-60 min., daily.

Tuberculous Glands.

Cut skin over gland under cocaine cat., anaesthesia or chloride ethyl spray, down to gland if possible; g. con., — distant, + to sharp point of zinc amalgamated with mercury, lab., to keep wound open, for drainage, etc., 1-3 ma., 2-5 min. Then insert gold tip, insulated, and amalgamated with mercury, as deep in sinus as can be; g. con., + 2-10 ma., 10 min., or till mercury is deposited, e. o. d. till cured. Dress with cotton and dioxygen and yellow oxide of mercury ointment. (See Carcinoma). (See Lecture 30).

Tumors, Malignant, (see Carcinoma).

Tumors, Vascular, (see Naevus, Vericose Veins and Vascular Tumors.

Ulcer, Exuberant, Fungus, Indolent, Phagedenic, Rodent, Sloughing, Syphilitic, Varicose.

G. con., copper or zinc elect. plain or amalgamated with mercury, + to surface or into ulcer, lab., — near by, stab., 5-20 ma., 5-15 min., e. o. d., s. breeze, s. s. to ulcer, X-ray, (see page 72,) soft tube through hole in lead mask; 3-10 min. exposure, 3 to 10 inches away, daily, till gray exudate appears, then less often. (See Lupus and Carcinoma).

Urine, Incontinence.

F. sec., fine coil in rectum, urethra or on pubes, other pad on abd., or perinaeum. Mild swelling currents, 5 min., daily; g. con., + pubes, — sacrum or perinaeum, or + sacrum, — feet, 10-20 ma., 15 min., daily; s. s. spine; s. ins., 20 min., daily. (See Incontinence).

Urethra, Female, Polyp.

Gal., cautery point, or g. con., — needle in growth + hand, 2-10 ma., 2-4 min., or g. con., + copper wire in growth, — hand, 2-5 ma., 2-4 min.

Urethra, Stricture, (see Stricture).

Urethra, Hyperaesthesia.

F. sec., fine coil, cold bare steel sound entire length of urethra, other pole, hand, mild current, 10 min., daily; g. con., — same as above, 2-5 ma., 5-10 min., daily. Hydro-elect. injection. (See page 93).

Urethra, Urethritis, (see Gleet).

Urticaria, (see Pruritus).

Electro-vapor bath. (See page 86).

Uterine, Atrophy.

F. prim., or s. ind., or g. int., — int., ut., + abd., or sacrum, 10-30 ma., 10-20 min., e. o. d.

Uterine Cancer, (see Carcinoma).

Uterine, Inertia, (see Obstetrics, Hemorrhage Post-partum, and Sub-involution).

Uterine Displacement.

F. sec., coarse coil, slow int., or s. ind., or g. int., — int.-ut., + abd., or back, 10-20 ma., 15-30 min., e. o. d. (See Sub-involution and adhesions).

Vaginal, Leucorrhoea, (see Endometritis and Leucorrhoea).

Vaginismus.

F. sec., fine coil, vag., and abd., or g. con., + aluminum or carbon elect., vag., 5-20 ma., — 10-20 min., daily; s. surge, + vag., — crown, 10-20

min., daily. (See Stricture). Put sphincter on tension with speculum or large rectal olive tip, attached to f. sec., or g. con., + 5 min., daily.

Varicose Veins.

G. con., + platinum needle in vein, insulated except tip; — near, 5–15 ma., 5–10 min., or till clot forms, reverse to loosen. (See Aneurism and Naevus.) G. con., + copper elect. same way.

Vascular Tumors, (see Naevus, Varicose Veins, Aneurism).

Verruca, (see Warts).

Vomiting of Pregnancy, (see Pregnancy).

Warts.

G. con., + to growth, covered by chromethylate sodium, — near. (See Moles).

Wakefulness, (see Insomnia).

Wine Marks, (see Naevus, Moles).

Wounds, Suppurating, (see Ulcer).

Wry Neck, (see Torticollis).

GLOSSARY AND INDEX OF ELECTRO-MEDICAL TERMS.

ABBREVIATIONS, KEY.—(see page 104).

Abdominal Spiral Spring Disc Electrode, Bennett's.—(See page 92).

Acid, Bichromate Cell.—(See pages 37, 39).

ACCUMULATOR.—An apparatus to store electric energy, as the Leyden Jar and Storage Battery. Also applied to a disc covered with foil, attached to an X-ray tube. (See page 47).

Agonic Lines.—Lines of no variation.

Alternate Currents.—Currents in which the direction is changed at regular intervals. (See page 64).

Amalgamation.—Coating zincs with metallic mercury. (See page 40).

Ampere.—The unit of current strength, or the current carried in one second, by the force of one volt, through a circuit where the resistance is one ohm. (See page 54).

Amperage.—Current strength. $C = \frac{E}{R}$ Current strength = pressure divided by resistance. (See page 54).

Anelectrotonus.—The condition of lessened irritability which exists in that portion of the nerve nearest the positive pole after a current of electricity has been carried through it for some time.

Animal Electricity.—Free electricity in the body. A misnomer.

Anions.—The atoms which collect around the positive pole when a compound is decomposed by electricity. (See page 33, 34).

Anode.—The “way” by which electricity enters. The positive pole. (See pages, 37, 76, 78).

Anode Rays.—The rays from the positive end of an X-ray or vacuum tube. (See pages 37, 76, 82).

Arc.—The spark or light made by the current jumping from one conductor to another.

Armature.—An iron bar attached to the poles of magnets to preserve their magnetism. A coil of insulated wire on a soft core or wheel, revolved in a magnetic field, and in which a secondary current is induced.

Ascending Currents.—The current applied by placing the positive electrode upon the periphery of a nerve, and the negative to the nerve center.

Atom.—An ultimate indivisible particle of matter.

Attraction and Repulsion, (see page 33).

BASE.—The part of a battery upon which is fastened the coil, posts, switches, or plates. (See page 57).

Bath.—Electro-static. (See pages 17, 18).

Bath.—Electro-therapeutic. (See page 86).

Battery.—An electrical apparatus complete, or the cells. (See page 59).

Battery Cells.—(See page 36).

Battery Fluid.—The acid solution for batteries, electropoion. (See page 40).

- Bichromate, or Red Acid cell.** (See pages 37, 39).
- Binding Posts.**—Clamps for connecting conducting wires with the electrical apparatus.
- Blue Stone cell.**—A gravity cell so called from the sulphate of copper it contains. (See pages 37, 43, 44.)
- Break and Make.** (See page 69).
- Break.**—An opening in the circuit.
- Breeze, Static.** (See pages 17, 19, 20).
- Bridge.**—The crossing of one conducting wire over another. Should be well insulated.
- Bugs and Beads.**—Dark spots on surface of fluorescent X-ray tube.
- B. W. G.**—Birmingham wire gauge, standard measurement of sizes and diameters of wires.
- CABINET,** Electro-Therapeutic Bath. (See pages 86-89.)
- Callaud Battery.**—Another name for the gravity battery.
- Carbon.**—A non-metal occurring in the various forms of diamond, graphite or "black lead" and charcoal, used as the negative element in a cell. (See pages 36-45.)
- Cataphoresis.**—The property of electricity which causes a transference of substances through moist tissues, by means of which medicines can be carried into the body. Especially useful in causing local anaesthesia. Cataphoresis is mechanical. (See page 31.)
- Cataphoric Action.** (See Cataphoresis.)
- Catalysis.**—The property of electricity which causes increased absorption and nutrition of the part

treated, or the whole body, through its effect on the vaso-motor and sympathetic nervous system. Catalysis is reflex and physiological. (See page 35.)

Catalytic Action. (See Catalysis, page 35.)

Catalectrotonus.—The state of increased irritability of a nerve near the cathode.

Cathode.—The “way” by which electricity leaves the body. The negative pole. (See pages 37, 76, 78, 82.)

Cathode Rays.—The rays from the negative end of an X-ray or vacuum tube. (See page 76.)

Cautery. (See Galvano-Cautery, pages 62, 71.)

Cell.—The jar or container, holding the elements and agent producing the electricity. (See page 36.)

Centimeter.—The hundredth part of a meter, equal to 0.39371, or about $\frac{2}{5}$ of an English inch.

Central Galvanization.—Method of applying a galvanic current to the nerve centers. (See page 52.)

Centrifugal current.—A descending current. From trunk toward extremities.

Centripetal current.—An ascending current. From extremities toward trunk.

Charger.—A small static machine of two plates used to charge a large static machine. (See page 84.)

Charging storage cell. (See page 48.)

Chloride of Silver cell. (See pages 37, 42, 43.)

Circuit.—The path traversed by the current

Circuit Breaker.—An apparatus for interrupting the current.

Clamp.—Appliance for completing the connection between electrodes and conducting cords. Binding posts.

Closed circuit cell.—One from which the elements are to be removed when not in use, and in which they are to be placed when to be used to close the circuit. The ordinary acid cells are closed circuit cells. (See pages 40, 44.)

Closing contractions.—Muscular contractions produced at the instant the circuit is closed.

Coil, induction.—Rolls of wire in which the current is induced by the alternate opening and closing of a circuit. (See pages 14, 63.)

Collecting plate.—The electro-negative element of the pair from which the positive current comes. Called the collecting plate because the hydrogen and other products of decomposition collect about it.

Columbia dry or paste cell. (See page 42.)

Combs.—A row of sharp points in a static machine for collecting the current from the plates.

Commercial currents. (See page 64.)

Commutator.—A device for changing the direction of the current. Pole changer. (See pages 57, 59, 67.)

Concentrator.—A single point electrode for localizing static sparks or breeze. (See page 20.)

Condensed Facts in Electro-Therapeutics. (See pages 97-103.)

Condenser.—An apparatus for accumulating or storing electric energy on a small surface. As an insulated metal plate, or ball, or Leyden jar.

Conductors.—A term applied to the electrodes and cords, by which they are joined to battery.

Conjunctive wire or arch.—The wire joining the two elements of a galvanic pair, outside the fluid.

Constant battery.—A galvanic battery with two fluid or gravity cells.

Constant current.—A galvanic current from a constant battery.

Controller, current. (See pages 59-68.)

Convection.—The discharge of electricity attended by alternate attraction and repulsion of particles of air, and the materials floating in it.

Convective discharge.—A mild static breeze or brush discharge from a point or brush electrode.

Copper Hydro-Soluble Electrodes. (See pages 93, 94.)

Core.—A bundle of soft iron wires used as a magnet in the center of a coil. (See pages 14, 63.)

Coulomb.—The unit of quantity.

Grooke's Tube.—A vacuum or X-ray tube named for the inventor. (See pages 74, 75, 76, 81, 96.)

Cross.—A short circuit, made by two uninsulated conductors coming in contact.

Crow-foot cell.—A gravity cell so called from shape of the zinc. (See pages 37, 43, 44.)

Crown breeze or shower. (See page 19.)

Currents, electric. (See page 10.)

Current breaker.—A device for opening and closing the circuit.

Current controller.—A device or rheostat for controlling an incandescent current. (See page 67.)

Current reverser.—A pole changer.

Current selector.—A device for altering the strength of a current.

Current strength.—Amperage. $C = \frac{E}{R}$ Current strength = pressure divided by resistance. (See page 54).

DANIELL'S CELL.—A porous cup containing dilute sulphuric acid immersed in a jar containing a solution of sulphate of copper. The elements are copper and zinc.

Dead wire.—One that is not charged with or conducting a current.

Declination.—The dip of the needle.

Density.—The amount of the electric energy accumulated on a unit of surface is called "density." The term is also applied to a large quantity passing over a small conductor, and the density of current—other things being the same—is in proportion to the size of the electrode.

Depolarizer.—Bichromate of potash or soda put in an acid cell, or binocide of manganese in an alkali cell, to unite with hydrogen liberated at the negative element, to prevent polarization. (See pages 40, 41.)

Derivation wire.—A wire connecting two points in a closed circuit.

Derived current.—A current drawn off by a derivation wire from the main current. A shunt.

Descending current.—Flowing from center to periphery.

Diagram of cell connections, of battery plate. (See page 45.)

Diamagnetic bodies.—Bodies not susceptible of being magnetized.

Dielectric.—Insulators across which electric action takes place, of which the air is the most transparent and elastic.

Diffusion of current.—The power of a galvanic current to extend its influence in all directions, that power never being limited to the two electrodes.

Directions for charging and connecting battery cells. (See pages 45, 46.)

Direct Spark. (See pages 17, 23.)

Discharger.—The instrument which directs the charge from a condenser through an object.

Disruptive discharge.—A violent static spark discharge from a ball electrode.

Dynamic electricity.—Electricity in motion.

Dry or paste cell. (See pages 37, 41, 42, 43.)

Dryers for static machine. (See pages 83-85.)

Dyne.—The unit of force i. e. the force which, if it acted for one second on a mass of one gramme, would, if the mass was previously at rest, give it a velocity of one centimeter per second;

or, if it was previously in motion in the direction of the force, would in that time alter its velocity by that amount.

ELECTRIC AURA.—A current of electrified air.

Electric brush.—A wire brush used as an electrode.

Electric moxa.—A burn made on the skin by electricity.

Electricity. (See page 9.)

Electrification.—The manifest energy of the electric condition. (See page 9.)

Electrization.—This term includes galvanization, faradization and franklinization. (See pages 50, 51, 52.)

Electrizers.—Metal discs of copper and zinc or silver and zinc, applied to the surface of the body and connected with copper wire, exciting with the perspiration, a feeble galvanic current.

Electro-Biology.—Electrical currents developed in living animal tissues by friction.

Electro-Bioscopy.—Testing the muscles by electricity to see if life is extinct.

Electrodes.—The instruments fastened to the conducting cords that are used in applying electricity. (See pages 90-95.)

Electro-Diagnosis.—The diagnosing of disease by means of electricity.

Electrograph.—A print showing the effect of a static spark on a sensitized plate.

Electrolysis.—A chemical decomposition. The process of decomposing a substance into its elemental gases by means of electricity. (See page 29.)

Electrolysis.—Separation or analysis of chemical substances by electricity.

Electrolyte.—Any compound body composed of water and a salt, subject to electrolysis.

Electrolytic.—Relating to chemical decomposition produced by electricity.

Electro-magnet.—A mass of soft iron surrounded by a coil of wire.

Electro-magnetism.—A current from a magneto-electric machine.

Electrometer.—Instrument for measuring the strength of the attractions and repulsions between electrified bodies. Also see electroscope.

Electro-motive force.—E. M. F. The voltage or pressure of current strength, $E = C \times R$, pressure = current strength multiplied by the resistance.

Electropoion fluid.—Acid battery fluid. (See pages 39 and 47.)

Electro-Therapeutics.—The application of electricity to the treatment of disease. (See index pages 105–138.)

Electrotonus.—The peculiar modification of irritability which nerves and muscles undergo when acted upon by a galvanic current. The condition of a motor-nerve when a continuous current is passed along it.

Electro-otiatría.—Electricity applied for diseases of the ear.

Electrophorus.—An instrument used to generate small quantities of static electrification, consisting of a pan of resin or sealing wax to be rubbed with fur, and a metal plate with an insulated handle.

Electro-Puncture.—Electrostixis. The application of electricity by means of needles thrust into the tissues. (See page 52.)

Electroscope.—Instrument for detecting the presence of static electrification and determining whether it is positive or negative.

Electro-Tonic.—The name given to the changing state of the conducting wires while the current is forming or ceasing.

Elements.—The metals, or carbon and metals, immersed in the battery fluid. (See pages 36–45.)

Equalizer.—A metal rod connecting opposite sides of static plates to equalize or neutralize waste charges.

Erg.—The unit of work; i. e., it is equal to the work required to move a body through one centimeter, against a force of one dyne.

Essential Resistance.—The internal resistance within a battery cell.

Eye cup Hydro-Electrode.—(See page 95.)

FACTS condensed in electro-therapeutics. (See pages 87–103.)

Fall and Rise.—(See page 69.)

Farad.—A million micro-farads. The unit of electrical capacity. Practically a capacity sufficient to overcome one coulomb of current having a potential of one volt.

Faradic Current.—Named after the discoverer, Faraday. Also called the induced, interrupted, secondary, to and fro, indirect, electro-magnetic,

magneto-electric, and extra current. The current generated in a coil of wire by electro-magnetic induction. (See page 13.)

Faradic Induction.—A current of electricity passing through a wire excites a wave of electricity in a second wire placed near and parallel with it at the instant of opening and closing the circuit. This is faradic induction. (See page 13.)

Faradism.—The application of induction currents to the treatment of disease.

Faradization.—The application of the induced current to a diseased part. (See page 50.)

Fluorescence.—Is the greenish yellow color on the surface of an excited X-ray tube. (See page 77.)

Fluoroscope.—An apparatus with a fluorescent screen for examinations with the X-rays. (See page 75.)

Forming a storage plate. (See page 48.)

Formula of Ohm's law.—(See page 54.)

Fox Tail Discharge.—A negative static phenomena. (See page 83.)

Franklinism.—Static electricity employed as a remedial agent. (See pages 10, 16.)

Frictional Electricity.—Electricity set free by friction.

Fustigation, Electric.—The application of electricity through a metallic brush.

GALVANIC BELT.—An appliance for the continuous application of galvanism, consisting of a series of small cells containing various elements.

Galvanic Chain.—A series of links composed alternately of zinc and copper, to be worn around the

body. The current is generated by the moisture supplied by the perspiration.

Galvanic Circle.—This usually refers to a pair of elements immersed in battery fluid and connected outside the fluid. A single circle is one galvanic cell in action. A compound circle is two or more connected together.

Galvanic Current.—(Named after Galvani) a current coming directly from the battery (not induced by a coil of wire) called also the continuous, constant, direct, voltaic current. (See page 10.)

Galvanic Disks.—Disks of two dissimilar metals arranged alternately, between which a communication is established when moistened and placed on the skin.

Galvanic Elements.—Two dissimilar metals used in generating a current of electricity. (See page 36.)

Galvano-Faradization.—The simultaneous use of two currents.

Galvanic Pessary.—An instrument for retaining the uterus in position and at the same time conducting to it a galvanic current.

Galvanic Poultice.—Minute pieces of zinc and copper wrapped in cotton-wool, each pair separated by flannel, all inclosed in a bag, one side of which is made of rubber cloth, and the other cotton. The cotton surface is applied next the skin, and the accumulated perspiration excites galvanic action.

Galvanism.—The form of electric energy which is generated by chemical action.

Galvanization, General and Central. (See pages 51, 52.)

Galvano-Cautery.—Burning or cauterization of the tissues by an electric current sent through a wire or plate of great resistance (usually platinum.) (See pages 62, 71.)

Galvano-Contractility.—Muscular contraction produced by the galvanic current.

Galvanometer.—An instrument for measuring the quantity of electricity. (See page 54.)

Galvano-Puncture.—(See page 52.)

Galvanoscope.—An instrument for detecting the direction and presence of a galvanic current.

Geissler Tube.—A vacuum tube for physical demonstrations of electrification and static polarity. See page 82, 83.)

General Electrization.—The application of electricity to all parts of the surface of the body during a treatment. (See pages 18, 50, 51.)

Gravity Batteries.—Galvanic cells in which the elements are placed horizontally, the two fluids are kept separate by difference in density. Also called crow foot or blue stone cell. (See pages 37, 43, 44.)

Grenet cell.—The early form of acid cell. (See pages 37, 39, 40.)

Ground circuit.—Connecting one pole of a battery or static machine to the floor, water or gas pipe, or the earth, by means of a wire, chain or cord. (See pages 18-24.)

HARD TUBE.—An X-ray tube having a high vacuum. (See pages 74, 75, 79, 96.)

Harmonic Wave Current. (See pages 17, 24, 25, 69, 72.)

Helix.—The coil of wires of the electro-magnetic battery. (See pages 14, 63.)

Hydro-Electrization.—Electricity applied by means of water as an electrode. (See pages 93, 94.)

Hydro-Electrodes. (See pages 93, 94.)

Hydrostat.—A device for preventing the spilling of fluid out of battery cells.

INCANDESCENT CURRENT.—The constant street lighting current of 110 volts used in medical treatments. (See page 64.)

Indirect Spark. (See pages 17, 23, 24.)

Induced charge.—When a charged body is brought near another, but not in contact with it, the latter becomes electrified or possesses an induced charge. (See pages 14, 17, 21.)

Induction.—The process of exciting electricity in any object by bringing it near to, but not in contact with, a circuit through which a current is passing.

Induction coil.—This refers to the coarse wire coil through which the primary current passes. (See page 14.)

Initial charge.—A charge excited on glass or rubber and conveyed to the plates of a static machine by contact. (See charger.)

Insulators.—Substances which hinder the passage of electricity.

Insulation.—Supporting or surrounding a body by an insulator. (See pages 17, 18.)

Intensity.—The energy or effectiveness with which electricity acts, often wrongly used instead quantity or amperage.

Interrupted current.—A current that is alternately opened and closed. (See page 13.)

Inverse current.—Ascending or centripetal current.

Ions.—Elements into which a substance is divided by electrolysis. (See page 33.)

JUICE.—A common commercial term applied to the electric current.

KEY TO ABBREVIATIONS. (See page 104.)

Kinraide Coil.—An improved high tension, induction coil apparatus, having Leyden jars for X-ray work.

LABILE APPLICATION.—Moving one or both electrodes over the surface, instead of being kept in one position.

Latent Electricity.—Passive, bound or natural electricity.

LeClanche Cell.—The first form of sal-ammoniac cell, with porous clay cups around carbon. (See pages 37, 38,)

Leyden Jars.—The ordinary form consists of a glass jar or bottle with an outside and inside coating of metal reaching within two to four inches of the top, an insulating cap fitting into the neck of the jar supporting a brass rod terminating above in a knob, and below in a strip of foil or chain that lies upon the inner metallic coating on the bottom of the jar, used as a condenser or accumulator of electric energy. (See pages 21, 22, 77.)

Lines of Magnetic Force.—The curved lines through which the force emanating from a magnet acts. (See page 63.)

Live wire.—One that is charged with, or conducting a current.

MAGNET.—A bar of steel or iron to which the peculiar properties of the lodestone have been imparted. (See page 63.)

Magnetic Axis.—The line joining the poles of a magnet. (See page 63.)

Magnetic Field.—Any region within the influence of a magnet. (See page 63.)

Magnetic Induction. (See faradic induction, pages 14, 63.)

Magnetize.—To communicate magnetic properties to substances that do not exhibit them.

Magneto-Electricity.—Electricity generated or set free by the action of a magnet. (See page 72.)

Make and Break. (See page 69.)

Massage roller application. (See page 21.)

Meter, Milliampere. (See pages 53, 54.)

Micro-Farad.—Practical unit of capacity. A condenser of one micro-farad capacity would contain about 300 circular sheets of tinfoil separated by mica plates, and would be contained in a box $3\frac{1}{4}$ inches deep and $6\frac{1}{2}$ inches in diameter.

Milliampere.—The unit of medical electricity. The one thousandth part of an ampere.

Milliampere Meter.—A meter for measuring electricity in milliamperes. (See pages 53, 54.)

Molecule.—The smallest quantity of matter that can exist in a free state.

Motor Points.—The points on the surface of the body where the various branches of the motor nerves supplying the muscles may be effected by electricity.

Multiplier.—A coil of wire through which a galvanic current is passed to increase or multiply its effect upon a magnetic needle played about it.

NEEDLE HOLDER, BENNETT'S. (See page 91.)

Negative Breeze (See pages 17, 19.)

Neutralizer. (See Equalizer.)

Negative Electricity.—Originally referred to that form of electricity developed by rubbing sealing wax. Electricity from any plate, condenser or element which effects the electroscope in the same way as sealing wax is called negative.

Negative Element.—That portion of the carbon, copper or platinum element immersed in the fluid is electro-negative. The zinc, from which negative electricity is obtained, is however, usually spoken of as the negative element. (See pages 37, 76, 82.)

Non-electric.—Those substances which permit electricity excited on them by friction to escape as fast as formed.

OHM.—The unit of resistance. About equal to the resistance of a cylindrical wire of pure copper 250 feet in length, having a diameter of $\frac{1}{10}$ of an inch.

$R = \frac{E}{C}$ Resistance = pressure $\div$ current strength.
(see page 54.)

Ohm's Law.—The law devised by Ohm for determining the current generated, and the amount of work it can do under given conditions, when the force of the battery and the resistance of the current are known. $C = \frac{E}{R}$. Current strength = pressure $\div$ resistance. (See page 54.)

Open Circuit Cell.—One in which the elements are left all the time, whether in use or not. The Le-Clanche, paste, silver and gravity cells are all open circuit cells. (See pages 38, 44.)

Opening Contractions.—Muscular contractions produced by opening or breaking the circuit.

Oxidation.—The rust collected on the metal parts of a battery.

PARA-MAGNETIC BODIES.—Bodies attracted by the magnet.

Paste or Dry Cell. (See pages 37, 41, 42, 43.)

Peripheral Electrization.—Electricity applied to the external surface of the body.

Phosphorescence.—The bluish white glow of a fluoroscopic screen caused by the X-rays. (See page 74.)

Phreno-Magnetism.—Excitement of the organs of the brain by mesmeric passes.

Pile.—The name given to a pile composed of disks of zinc and copper separated by a moist, porous material. Frequently applied to the combination of elements in battery cells.

Polar.—Relating to the poles.

Polar Force.—That force with which similar ends of magnets repel, and dissimilar ends attract each other. Polarity, (See pages 29, 30, 33, 34, 35 and 82.)

Polarity of Elements. (See page 33.)

Polarity of Nerves.—The condition of a nerve in which the part nearest the negative pole is in a state of increased, and that nearest the positive is in a state of diminished, irritability.

Polarity Tests of Battery or Machine. (See pages 82 and 83.)

Polar Method.—This is accomplished by placing the pole whose distinctive effect is wanted, over the part to be treated, and the other pole over some indifferent part.

Polarization.—The act of forming poles or points of intensity having qualities mutually opposite. Formation of a film of hydrogen gas on the negative element in a galvanic cell, insulating it and stopping the generation of an electric current. (See pages 40 and 41.)

Pole Changer.—A device for changing the direction of the current without moving the electrodes. A commutator. (See pages 57, 59–67.)

Poles, Electric.—Points where electricity passes in and out.

Positive Breeze. (See page 20.)

Positive Electricity.—That which is set free by rubbing glass with silk.

Positive Insulation. (See pages 17, 18.)

Positive Pole.—The binding post, conducting cord and electrode connected with the carbon, copper or platinum, (electro negative) element of the battery. The anode. (See pages 37, 76, 82.)

Positive Indirect Spark. (See pages 17, 23.)

Potential.—This item holds the same relation to electricity that the term level does to gravity. Just as water at a higher level tends to flow to a lower one, so electricity at a higher potential tends to move to a point of lower potential. It is often used synonymously with tension, but since the latter term is used to express very diverse conditions, electricians now make use of the term potential in referring to “electric level,” whether static, dynamic or magnetic. (See pages 25, 37.)

Potential (Dynamic.)—Difference of “electric level” between two elements, when both are immersed in the same fluid, which acts chemically upon one of them. The same term applies to difference in electric level produced by revolving coils of wire between the poles of horse shoe magnets.

Potential Variation, or Surging. (See pages 17, 24, 25.)

Pressure.=voltage or electro-motive force.

Primary Coil.—The layers of coarse wire which form the inner coil of the helix. (See pages 14, 63.)

Primary Current.—The inducing current from the primary coil. (See page 13.)

Prime Conductors.—The poles of a static machine, usually large balls in front, supporting the sliding rods. (See pages, 21, 77, 78.)

QUALITY.—Of a current refers to the smoothness or harshness, or to the rapidity or slowness of interruption.

Quantity.—The amount of electricity generated in a given time.

RADIANCE.—The glow or brilliancy of an X-ray tube. (See page 77.)

Radicals.—The ions or elementary atoms into which the chemical compound is divided by electrolysis.

Radiograph.—An X-ray picture, a print of the effect of the X-rays on a sensitized plate. (See pages 77, 80.)

Red Acid Cell. (See pages 37, 39.)

Regulators, Vacuum. (See pages 96, 97.)

Repulsion and Attraction. (See page 33.)

Resinous Electricity.—That which is excited by rubbing wax or resin with flannel.

Resistance.—Is the quality of a conductor which impedes the action of the current. $R = \frac{E}{C}$ Resistance = pressure divided by current strength. (See pages 54, 55.)

Reverser. (Current) Pole changer.

Rheochord.—A metallic wire introduced into a circuit to vary the strength of the current. Rheostat.

Rheometer.—Galvanometer, Milliampere Meter.

Rheomotor.—The apparatus by which an electrical current is originated. Dynamo.

Rheophore.—An electrode. Conducting cord.

Rheoscope.—A galvanoscope.

Rheostat.—An instrument for bringing a definite amount of resistance into the circuit. A current controller. A resistance box, coil or column of water. (See pages 59, 63.)

Rheotome.—A current breaker. Interrupter.

Rise and Fall. (See page 69.)

Roentgen Rays. The X-rays. (See page 72.)

Roller Massage Application. (See page 21.)

Rotary Machine.—Magnetic electric machines in which electricity is generated by turning a crank. A magneto-machine. Dynamo.

Rubefaciant.—A scourge or wire brush. A cloth covered disc dry static electrode. (See page 90.)

Ruhmkorff Coil.—A very powerful induction coil invented by Ruhmkorff. (See page 73.)

SAFETY FUSE.—A soft lead wire interposed in a circuit, which will melt if too strong a current passes, for safety.

Sciagraph or Skiagraph.—A term of architecture very often incorrectly used instead of radiograph, which is correct. (See pages 77, 80.)

Scourge.—A wire brush electrode, for counter-irritation, (See page 90.)

Secondary Battery.—A storage battery. (See page 47.)

Secondary Coil.—A coil of fine wire wound in many layers around the primary coil from which it is separated by insulations. (See page 14.)

Secondary Current.—The induced current from the secondary coil. The faradic current. (See page 13.)

Sectors.—Small metal discs or plates attached to the surface of revolving plates of a static machine.

Sensibility, Electro-Muscular.—The peculiar sensation produced on a muscle contracted by electricity.

Shadowgraph.—A radiograph or X-ray picture. (See pages 77, 80.)

Shield.—The tube or sheath which answers the purpose of a current regulator. (See page 14.)

Shock.—A sudden discharge of electricity. The impression made on the nerves by opening or closing the circuit or increasing its strength.

Short Circuit.—A circuit completed before the current reaches the conductors or electrodes. A metallic or other contact of little or no resistance between the elements outside the cell. The touching together of the elements inside the cell. (See pages 38, 39, 56.)

Shunt Circuit.—A part of the current from the main electric circuit over another line like a switch alongside a railroad. (See pages 62 and 67.)

Silver Cell.—The chloride of silver cell. (See pages 37, 42, 43.)

Sine Curve Current. (See pages 69, 70.)

Sinusoidal Current.—A smooth alternated harmonic wave current. (See page 69.)

Skiagraph. See Sciagraph.

Sliding Rods.—The horizontal movable rods in front of a static machine attached to the prime conductors

for the purpose of regulating the spark gaps and also to short circuit the machine. (See page 21.)

Soft Tube.—An X-ray tube having a low vacuum. (See pages 74, 75, 79, 96.)

Soluble Electrodes. (See pages 93, 94.)

Spark Gap.—The space between the balls of the sliding rods. (See page 21.) Or in a Crooke's tube circuit for X-ray work. (See pages 77, 78, 96.)

Stabile Application.—A current applied with both electrodes in a fixed position.

Statical Electricity.—Electricity at rest. (See pages 16, 74.)

Stepdown Transformer. (See page 71.)

Storage Battery. (See pages 47, 48.)

Streamers.—Static discharges from X-ray tubes and connections. Supposed to cause burns.

Suggestions on Meters. (See page 53.)

Surging, or Potential Variation. (See pages 17, 24, 25.)

Swelling Current.—Gradually increasing and decreasing current, without interrupting, repeated every minute or two.

Switch.—Metallic bars revolving on a pivot, used to connect sections of cells, as current reversers and current selectors. They form a part of the battery accessories that are attached to the base. (See pages 57, 59.)

Switchboard.—Term applied to an apparatus consisting of a wooden, rubber or stone base upon which is permanently mounted switches, posts, coils,

meters, rheostats, etc. The whole comprising a table or wall plate, for electro-therapeutic use. (See pages 45, 57.)

TENSION.—The tendency of electricity to overcome resistance. The strain put upon the circuit by the electro-motive force; quality; voltage.

Tesla Coil.—A very powerful high tension compound induction coil invented by Tesla. (See page 73.)

Tetanization.—The production of a contracted condition in a muscle, or temporary paralysis in a nerve, by an electric current.

Therapeutic-Electro, Index of Treatments. (See pages 105–138.)

Thermo-Electricity.—Electricity that is generated when two metals are soldered together so as to form a closed circuit, and one of the junctions is heated more than the other.

Thermo-Electric Bath. (See pages 86–89.)

To and Fro Current.—Faradic current. (See page 13.)

Transformer.—A step down induction coil; the ordinary faradic coil reversed, having a coarse coil outside, around a fine coil. By passing a high voltage current through the outer coil a lower voltage current is derived from the inner coil by induction. (See pages 71, 72.)

Tray Cell.—A gravity cell, named from its shape. (See page 44.)

Trembler.—The vibrator. (See page 14.)

Tube Holder.—Clamp for holding an X-ray tube. (See page 76.)

Two Fluid Cell.—A cell in which a different fluid is used with each element.

ULTRA-VIOLET RAYS.—Rays invisible, because beyond the violet of the spectrum. X-rays. (See page 73.)

Uninterrupted Current.—The galvanic current. (See page 10.)

Unit of Current.—An ampere. (See pages 54, 139)

Unit of Force.—One volt. (See pages 54, 165.)

Unit of Resistance.—The ohm. (See pages 54, 156.)

Unpolarized Electrodes.—Electrodes made of pure amalgamated zinc.

VACUUM REGULATORS. (See pages 96, 97.)

Vacuum Tubes.—X-ray or Crooke's or Geissler tubes, from which the air is nearly all pumped. (See page 76.)

Variation of Potential, or Surging. (See pages 17, 24, 25.)

Vibrator.—The hammer or pendulum spring of an induction coil. (See page 14.)

Vitreous Electricity.—That excited by friction of glass.

Volt.—A unit of electro-motive force or pressure. (See page 54.)

Voltaic Alternations.—When a pole changer is introduced into the circuit so as to break not only the circuit, but change the direction of the current at every break, the method has been named voltaic alternations.

Voltmeter.—An apparatus for measuring the pressure of the galvanic current.

Voltage.—Electro-motive force or pressure. $E. = C. \times R.$ Voltage = current multiplied by resistance.

WATER, Soluble Electrodes. (See pages 93-94.)

Watt.—The unit or amount of work done by one ampere of current when forced by one volt of pressure. Watt = amperes multiplied by volts. $W. = A. \times V.$ 746 watts = one horse power, which is that amount of energy required to lift 33,000 pounds one foot high in one minute. Horse power of electric current = amperes multiplied by volts, divided by 746. $H. P. = A. \times V., \div 746.$

X-RAYS.—The unknown quantity. The invisible light discovered by Roentgen in 1896, an ultra-violet light, penetrating opaque substances. Not reflected or refracted. (See page 72.)

X-Ray Burn.—A dermatitis caused by too close or too long continued exposure of the skin to the action of the X-rays. (See page 74.)

X-Ray Pictures.—Radiographs, shadowgraphs. (See pages 77, 80.)

X-Ray Tube.—Crooke's tube. (See pages 76, 81, 96.)

ZINC.—A metal used as the positive element in a battery cell. (See pages 36-45.)

BOOKS AND JOURNALS WE RECOMMEND.

International System of Electro-Therapeutics Bigelow.....	price net, 6.00
The Treatment of Diseases by Electric Currents, Monell	price net, \$6.00
Conservative Gynaecology and Electro-Therapeutics, Massey.....	price net, 3.50
Elements of Correct Technique, Monell.....	price net, 2.50
International Text Book of Medical Electro-Physics and Galvanism, Bigelow.....	price net, 2.00
Elementary Principles of Electro-Therapeutics, Haynes.....	price net, 1.50
Electro-Therapeutical Practice, Neiswagner..	price net, 1.25
Electro-Therapeutic Guide, Howe & Bennett..	price net, 1.00
Rudiments of Modern Medical Electricity, Monell	price net, 1.00
Electricity in Removing Superfluous Hair and Other Facial Blemishes, Hayes.....	price net, 1.00
Plain Talks on Electricity and Batteries With Therapeutic Index, Bigelow.....	price net, .50
A Compend of Electricity and Its Medical and Surgical Uses, Mason.....	price net, .25
Journal of Advanced Therapeutics, monthly...	per year, 3.00
American X-Ray Journal, monthly.....	per year, 3.00
American Electro-Therapeutic and X-Ray Era.	per year, 2.00
The Electro-Therapeutist, monthly.....	per year, 1.00

ELECTRICITY AS A SPECIALTY FOR THE GENERAL PRACTICIAN.

Specialism is the order of the day. The time is past when one man can do it all. In this era, the doctor to succeed must excel in something. He must know something about everything, and must endeavor to know everything about some one thing. That branch to which he is most attracted will be the one to which he will devote the most time and study, and it will be naturally followed up, and if he masters the details and technique of that branch, then he will have the best success with it, and this will eventually become his specialty. Some specialties are forced upon physicians against their will by circumstances, but the most of them are at liberty to select the special line of study most congenial to their tastes, and best adapted to their ability and field of work. The physician should first, however, have the invaluable schooling only acquired in general practice, without which the specialist is handicapped, so that specialists are not made all at once. Electro-Therapeutics is now becoming firmly established as a branch of medicine. Electricity has its uses and limitations as a medicine. It is not a cure all, but when scientifically applied in selected cases it will do things that nothing else will. The chief danger in the use of electro-therapeutics is not in the agent itself, but in the person using it. If ignorantly or carelessly applied, it may, and often does do harm, and brings disappointment, whereas, if rightly and intelligently used, it gives uniform satisfaction and brings success. It is an axiom that a power for good when rightly used, is as great a power for harm when wrongly used, in proportion to its potential, and this applies strongly to electro-therapeutics. Electricity must not be applied by guess. The laws of its operation must be understood, therefore, a preliminary education in electro therapeutics is an absolute essential to success. Correct technique is everything. There are many doctors who have the idea that all that is required is a battery and a few directions. There is just as much sense

in this belief as there is to say that all that is required to make a doctor is a stock of drugs and a few instruments. It is just as necessary to understand physics, chemism and physiological effects of electricity, as it is to understand the same of any other medicine. Nearly every doctor has a battery, which means that every doctor does NOT know how to use it. "'Tis true, 'tis a pity, and pity 'tis, 'tis true," but doctors are awakening rapidly to the fact that they must have something besides a battery, and must have at least a working knowledge of it and its uses. This knowledge can be obtained by experience, study and experiment, but at what a cost of time, money and disappointment. There are many books published on the subject for sale now, of more or less value to the operator, but of more value to the specialist as a reference. There are also several journals published along these lines exclusively, while a number of the medical journals have departments devoted to electro-therapeutics. Probably half a dozen medical schools in the country have chairs ostensibly devoted to electro-therapeutics, but it remains for the post-graduate schools and the special schools, of which there are a number now in existence, to promulgate the teachings of electro-therapeutics, to such as are most interested in that branch. The great majority of physicians however, are too busy to leave their homes and practice to attend at these special schools, yet they feel the vital need of more knowledge in electro-therapeutics. They are very busy and have little or no time to devote to experiment, and the knowledge to be gained from the average text-book on the subject is to say the least unsatisfactory, therefore, there is an absolute need for a simple, practical mail course of instruction in electro-therapeutics, which the busy doctor can take at home, and which at the same time will give him just the information he needs concerning the apparatus to be used, the nature and effects of the different currents, and the simple facts plainly stated to guard him against mistakes, and guide him in the right direction in medical electricity. Such a course has been prepared, and has been in use by The National College of Electro-Therapeutics, Lima, Ohio, which was chartered in 1896. The course consists of thirty lectures written by specialists in different lines, who are also writers and teachers. They are simple and practical, omitting all cob-web

theories and stating only facts that can be easily demonstrated. This course is meeting with increased favor, as thousands of unsolicited testimonials from busy doctors all over the world will verify.

The question is often asked by general practitioners whether the ends will justify the means, for them to equip themselves with proper batteries, and use the same in their general practice. To such we reply that if they once become posted and apply electricity as they would any other medicine, the ends will ALWAYS justify the means, and a GOOD battery is one of the best assistants the busy doctor can have, and when they once begin to look for places to apply it they will never cease finding openings where it will be of great assistance to them, both professionally and financially. The general practitioner can make a specialty of electro-therapeutics without necessarily confining himself to it as a specialty, and the mail course referred to above is intended for the general practitioner, although many eminent specialists have taken the course, and warmly commend it. The great majority of the alumni of the National College of Electro-Therapeutics are busy doctors in general practice, many of them in country practice. We have one doctor in mind, over sixty years of age, doing general practice, and in a village of 700, who has an office equipment of electro-therapeutic apparatus costing nearly one-thousand dollars, which he has made pay for itself many times over in the last few years, and with which he is now busy all the time in his office, having relegated his outside practice to his son, and he recently stated that during the past year he had given over fifteen hundred electro-therapeutic treatments, without a single complaint. We know of other doctors equally well equipped in locations ranging from small villages to large cities, all of whom are succeeding in electro-therapeutics.

The field of application is so large and the indications for the use of electricity as a medicine so plentiful, and the results following its use so satisfactory that when once in the field, they invariably stay with it. One of our students became so enthusiastic recently that he wrote that he had decided to abandon practice of medicine entirely, and devote himself exclusively to electro-therapeutics, as he had found a remedy

that would meet all his needs. We were sorry to do it, but we had to throw a cold blanket over his enthusiasm because electricity is not a cure all, and will not take the place of all remedies, but should be used in conjunction with other means and methods of treatment wherever and whenever indicated, only applying electricity when it seems most indicated just as you would any other form of treatment. Enthusiasts are all right, but sometimes they overdo it, and make promises they cannot fulfill, and often disappoint themselves and patient. A wise discrimination is necessary to successful therapeutics. The day is coming when the true physician will not be hampered by a limitation of schools, pathies, isms or narrow dogmas, but will be like the bee, gather honey from all the flowers, appropriating and using only the best from each, in other words, the coming doctor will be treating his patients with whatever he thinks will relieve or cure most safely, quickly and pleasantly, whether it be drugs, of large or small doses, or no dose at all, baths, massage, electricity, suggestion, sunshine or moonshine.

The doctor who is not posted in electro-therapeutics will seldom see any indications for its use, while the doctor who is well acquainted with its properties and power will be always finding cases in which it can be applied with great advantage, as there is scarcely any limitation to its usefulness in some way or other. In this rapid age where most of us are nervous dyspeptics, electro-therapeutics has a great field for usefulness. The combination of nervous unbalance, termed americanitis, especially calls for the soothing application of electricity to restore the normal equilibrium.

CHARTERED 1896

The National College of Electro-Therapeutics

LIMA, OHIO

DO YOU KNOW that Electro-Therapeutics is the most satisfactory, and best paying, and least crowded branch of medical practice **?**

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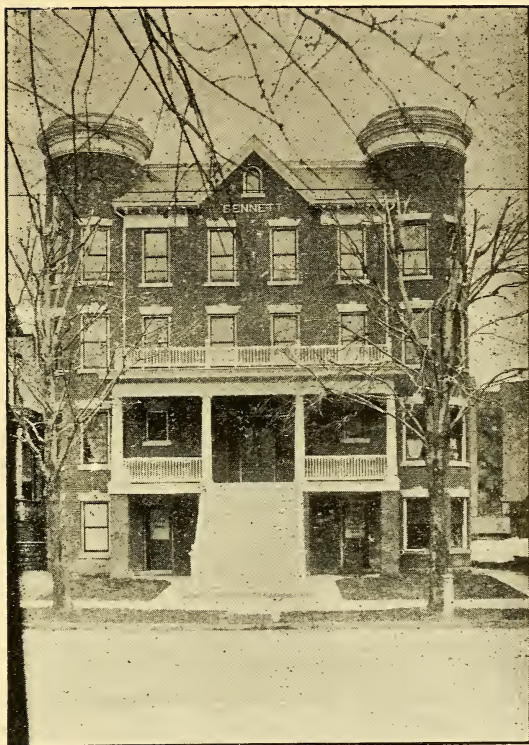
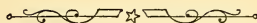
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MAIL COURSE OF INSTRUCTION IN ELECTRO-THERAPEUTICS vs. A TEXT-BOOK.

The inquiry has been made by some as to the advantages offered by the correspondence course of instruction given by the National College of Electro-Therapeutics over some good text-book upon the same subject. The following reasons should, we think, be convincing to any one:

First. A text-book is usually kept as a work of reference, and the matter contained in the book is rarely **LEARNED**. The more interesting parts of the book are hastily read and the work laid aside, and has to be consulted whenever an unusual case is presented. In the course of instruction given by mail, the student or physician taking the course, begins at the very beginning of electro-therapeutics, and learns electro-physics and all the laws and principles involved in electricity as applied to medical practice. This knowledge is rarely secured in a text-book. The mechanism of batteries, coils, etc., is given in the course of lectures in a plain manner, so that all may learn the construction of their batteries and how to keep them in repair. The work advances gradually, each subject being taken up separately and being explained in such a manner that all can understand it. Each lecture or lesson must not only be read and studied, but must be learned and thoroughly understood before another lesson is given. When the course is completed the knowledge is in the student's head and not in a text-book in the library.

Second. Nearly all text-books contain much superfluous matter, that is confusing to the student. This is eliminated in the course of lectures, which are condensed as much as possible.

Third. A text-book is usually written by one person. The course of lectures is the work of twenty physicians, who have had special training and experience in their respective departments. It is reasonable to suppose that twenty men can cover the ground in a more thorough manner than one or two.

Fourth. Much of the work in a text-book, particularly in electro-physics, cannot be readily understood by the general practitioner who has not made a study of the subject. In taking the lecture course, if any subject is not made perfectly clear, the student writes in for more light, and every point is carefully explained in a personal letter.

Fifth. Physicians often have cases where they would like to use electricity, if they were sure that electricity was the indicated treatment, and how to apply it. Many of these cases cannot be looked up in any text-book. Physicians taking the course of lectures are requested to write to the faculty for help in all such cases, and a letter giving full directions is sent by return mail free of charge (except postage). This has been of very great assistance to a large number of practitioners.

Sixth. Physicians taking the course of lectures can secure batteries, or any electro-therapeutic appliance, from ten to fifty per cent lower, through the college, than in any other manner. Batteries will be repaired for students at very low rates.

Seventh. Many of the text-books are not up-to-date. The lecture course is being constantly added to and greatly improved. To those who care for it, we also give instructions in Turkish, Russian, medicated, and electric baths, massage, suggestion, etc.; and this work is not given in any text-book on electro-therapeutics.

Eighth. This guide book is furnished with the lectures, and an elegant diploma given to those who satisfactorily complete the course. (See page 183.)

Ninth. A series of quizzes and examinations is carried on during the course of lectures, and the answers show whether the lectures have been understood and learned or not. If errors are found, the same are corrected, and the lectures sent back for further study.

Tenth. The student has the personal aid of the faculty in all matters pertaining to electro-therapeutics.

The Course of Instruction.

The course of instruction is given in two classes, the personal and the correspondence class, and consists of thirty lectures carefully prepared and written by twenty able specialists, with a quiz on each one, and a middle and final examination. These lectures are clear and comprehensive, yet simple and easily understood, and are especially intended for the general practitioner and beginner in electro-therapeutics, who knows little or nothing about the subject. They begin with the fundamental principles of the subject and cover the ground well, taking up each subject in turn and discussing it in a practical manner, gradually advancing, until, when the course is finished, the student has a good understanding of the subject, and is well qualified to begin practice and study for himself intelligently. There is included with each course a copy of "The Electro-Therapeutic Guide," which is the only book of the kind published and is invaluable to the busy doctor, as it contains the essence of the entire course, without any useless words, and tells what treatments to give, where and how often and how long to apply the different currents, without telling why, as that is supposed to be learned in the lectures. This little book, alone, is worth the price of the course. (See coupons, pages 181, 182).

In the Personal Course, these lectures are explained to the student, and he is drilled in their teaching, and is shown practically how to operate apparatus and treat cases, and hundreds of minor details are explained to him.

The average time for the personal course is six weeks, but many can take it in much less time.

In the mail course of instruction, the lectures, quizzes and examinations are sent to the student by mail, and he studies the lectures and returns them, and we send him the quizzes on them and additional lectures until he is finished, when he passes the final examination and signs an affidavit, stating on his honor, that he has had no assistance whatever in answering the quizzes and examinations, from any person or book, lectures or notes, but has depended entirely upon his own memory and knowledge. At the completion of the course, if found qualified, each student receives a copy of the diploma, shown on page 183 (see foot note), which is a work of

art, handsomely engraved on stone and printed on heavy parchment paper, and is of the regulation size, being 19x24 inches.

The fee for the personal course is \$50, which includes the degree diploma. The fee for the mail course is \$20, and we will accept a cash payment with the order, of five or ten dollars, the balance to be paid in monthly payments of \$5 each, the unpaid balance, if any, payable on delivery of the diploma, C. O. D., with privilege of examination; or if you wish to discount the fee, we will accept a cash payment in advance of \$18 for the entire course, book and diploma.

The mail course is for the benefit of the general practitioner, who does not use electricity often enough in his practice to justify him taking the personal course, and yet who would like to have a more thorough understanding of the various currents and how to properly apply them in the treatment of disease. We wish to emphasize the practical value of this mail course of instruction to the general practitioner, as it enables him to take a post graduate course at home, without interfering with his general practice, and for those who do not intend making a specialty of electro-therapeutics, this course will be found sufficient.

We also make and sell anything in the way of electrical apparatus you desire at approximate cost to our students, and we can secure them discounts on other goods, which they could not, otherwise, obtain. We also give them the privilege of consultation and advice, concerning their cases by mail, free of any charge, except for postage, and we aid them in many ways.

We do not limit our students, taking the mail course, as to the time, and they can take it as rapidly or as slowly as they wish. The honorary degree of "Master of Electro-Therapeutics" is sometimes conferred upon those taking the mail course who are especially qualified. Write for annual announcement, and sample copy of "The Electro-Therapeutist." Any further information will be cheerfully given on application to

H. C. BENNETT, M. D., M. E., Sec'y and Treas., Lima, O.

Special Mail Course in Electro-Dermatology.

We have had numerous inquiries for special courses from dermatologists, nurses, masseurs, and assistants in colleges, hospitals, sanitariums, homes and public and private institutes where electricity is given in connection with baths, massage and other hygienic treatments. We have selected twelve different lectures from the regular course, which take up those lines of special work in which the applicant who may not be a physician in active practice is interested. There is an almost unlimited field for the practice of general and special electro-therapeutics, and the success in selected cases is marvelous, and the best of it is that the field in this special line of treatment is not over worked or crowded, as it is in all other specialties.

This is especially so in the field of electro-dermatology for the removal of superfluous hairs, and small growths, marks and other facial and bodily blemishes, and for this course we have a special diploma (see page 179.) The lectures are written in simple language so that anyone can understand them, are illustrated, and are interesting, instructive, valuable and above all practical. The course covers the field in a comprehensive manner giving the student a good working knowledge of electro-physics, chemism, cataphoresis, catalysis, electrolysis, batteries, currents, galvanic, faradic, cautery, static, x-rays, baths, massage, general therapeutic indications, and all with special reference to the use of electricity in dermatology. It teaches the removal and cure of superfluous hairs, warts, moles, birth marks, freckles, blemishes of all kinds, wrinkles, skin diseases, lupus and cancer, with electricity and x-rays.

The dermatology diploma (see next page) goes in with the full mail course for an extra fee of \$5.00. The dermatology course and diploma taken alone will be sold for \$12.00 in payments or \$10.00 cash. This special diploma is a handsome document, being half tone, with the same heading as the regular diploma, printed on heavy paper, 10x16 inches, in gold, with the name of the student and the signatures of the officers written in gold ink and the gilt seal, making when placed in a neat gilt frame a beautiful ornament for your office wall aside from what it represents in its text, and is illustrated opposite.

We can supply students with any kind of electric apparatus and books for this work at low prices.

THE NATIONAL COLLEGE OF ELECTRO-THERAPEUTICS, Lima, O.



Be it Known, That *Homer C. Bennett*,
having completed the prescribed course of instruction in this
College, and having passed the required examination, and
having furnished satisfactory evidence of a thorough knowl-
edge of the subject of

Electro-Dermatology

as applied in the Removal of Superfluous Hairs, Small Growths,
and Facial and other Blemishes by Electrolysis;

Now, Therefore; We, the Officers of this College, by
the authority vested in us by the State of Indiana, do grant
to him this

DIPLOMA

with all the rights and privileges thereto pertaining.



Witness. The seal of this College and the
signatures of its Officers, at the City of Lima, State
of Ohio, this first day of October, 1900

J. M. Longenecker M.D. President
H. C. Bennett M.D. Secretary

The Electro-Therapeutist

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H. C. BENNETT, M. D., M. E., Lima, O.

THE NATIONAL COLLEGE of Electro-Therapeutics.

TO ALL TO WHOM THESE

PRESENTS SHALL COME.

GREETING

Be it Known That: Homer Clark Bennett

Having satisfactorily completed the prescribed course of instruction in this College and passed the requisite examination, and having furnished satisfactory evidence of a thorough knowledge of the subjects of

ELECTRO PHYSICS AND ELECTRO THERAPEUTICS

Now, Therefore: We, the Officers of this College, by the authority vested in us by the State of Indiana grant to him this

Diploma

and confer upon him the Degree of Master of Electro-Therapeutics with all the rights and privileges therewith pertaining

Witness: The Seal of this College and the signatures of its officers at the city of Lima, State of Ohio
this **First** day of **October**, 1900.

Heber Roberts, M.D., M.E. *H. Clay Reese, M.D., M.E.*

Edwin A. Evans, M.D., M.E. *Magpie Wessoff, M.E.*

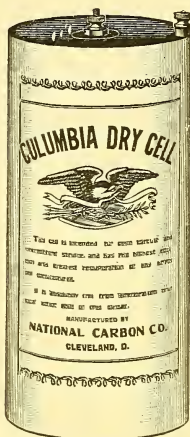
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Hos. Bennett, M.D., M.E. *Charles J. M. Long, M.D., M.E.* *President*

N. B. The above engraving represents our diploma, which is of the regulation size, 19x24 inches, given with the PERSONAL course. The diploma, given with the mail course is exactly the same as above, except that the line conferring the degree "Master of Electro-Therapeutics" is omitted, as that goes only with the personal course. We also have a special course and diploma in Electro-Dermatology.—(See page 179.)

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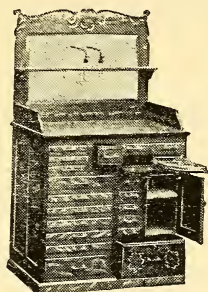


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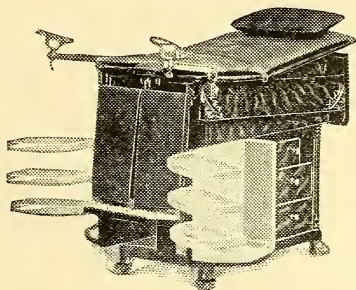
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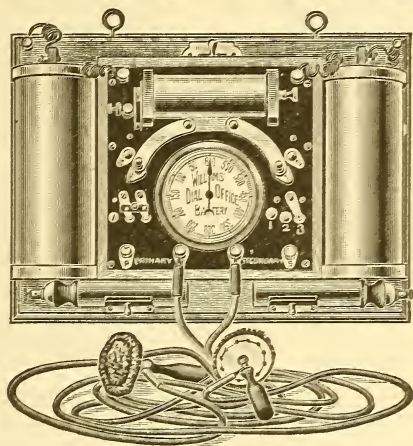
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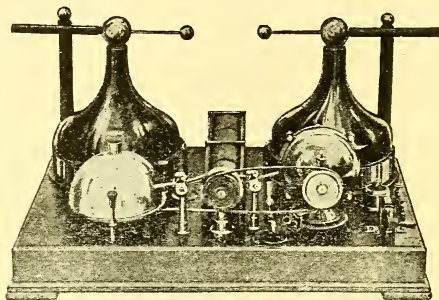
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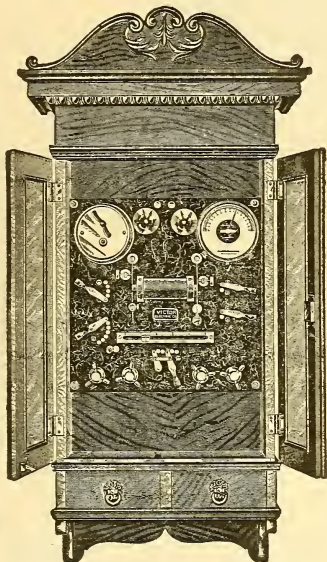
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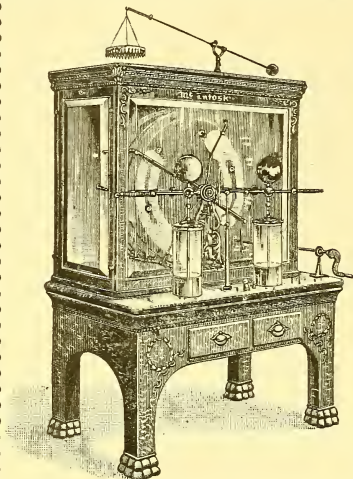
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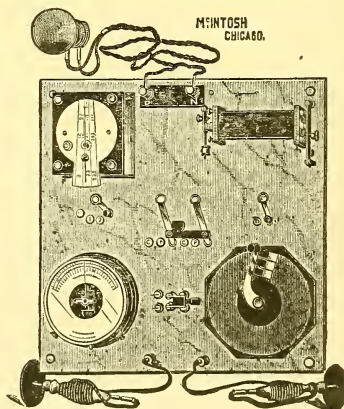


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